SCIENCE IN SEARCH OF GOD

BY

KIRTLEY F. MATHER

PROFESSOR OF GEOLOGY IN HARVARD UNIVERSITY

LIBRARY OF
Bangbrake Theological Seminary
BL
240
.M36
1928
C.1.
7,859

NEW YORK
HENRY HOLT AND COMPANY

COPYRIGHT, 1928,
BY
HENRY HOLT AND COMPANY

PRINTED IN THE
UNITED STATES OF AMERICA BY
J. J. LITTLE AND IVES COMPANY, NEW YORK

To

MY MOTHER

JULIA KING MATHER

WHO EARLY ENCOURAGED HER CHILDREN
TO SEEK IN FACTS AND EXPERIENCES THE REAL BASIS
FOR RELIGIOUS FAITH

PREFACE

Early in 1924 I was requested by a group of students in Denison University, where I was at that time Professor of Geology, to lead a series of discussions concerning Science and Religion. The controversy between "Fundamentalism" and "Modernism" was then waxing warm and many young people were awakening to a consciousness of the new light which the scientific habit of mind was throwing upon the foundations of religious beliefs. In the years that followed, other groups of students at other colleges, at summer conferences and elsewhere, have similarly indicated their deep desire to cut away the husks of traditional doctrines to discover if possible the kernel of truth which may serve as a truly satisfactory basis for their philosophies of life. As a rule the atmosphere at such student gatherings was quite in contrast

to that which I found at Dayton, Tennessee, in the summer of 1925, during the trial of John T. Scopes in whose defense I had been asked to appear as a witness. Nevertheless, the experiences on that occasion indicated the widespread influence of the new knowledge as it made its impact upon the old dogmas. No scientist could well escape the necessity of considering carefully and conscientiously the problems which I have tried to discuss in this little volume.

Such trains of thought were focussed in 1927 by an invitation to deliver six lectures on Science and Religion at the Institute of World Unity during a session held at Green Acre, Maine. These lectures were subsequently published in "World Unity Magazine" and have been slightly altered and somewhat expanded to make the six chapters of this book. I am deeply indebted to John Herman Randall and Horace Holley, editors of "World Unity," for permission to use in this way the articles which had appeared in that magazine.

It is of course impossible to make due

acknowledgment to the many individuals who have contributed the ideas which have filtered through my mind upon the pages which follow. Impressions received, phrases heard or read, questions which stimulated thought, suggestions offered toward solutions of problems, all these and more are inextricably interwoven in the mind of any author. No one can realize more than I, my indebtedness to others for whatever of good there may be in the principles set forth herewith. Especially am I indebted to my wife for kindly encouragement, wise counsel, and editorial guidance in the preparation of this manuscript.

K. F. M.

Cambridge, Massachusetts
May 15, 1928.

CONTENTS

CHAPTER		PAGE
I.	The New World Revealed by Modern Science	3
II.	Science and Religion: Are they Friends or Enemies?	32
III.	The Search for God in a Scientific World	55
IV.	Men and Machines	71
V.	Miracles and Prayer in a Law-abiding Universe	106
VI.	The Present Trend of Science and Religion	131
	Index	157

"Nor will I let the teachings of another
Absolve me from my task of finding out;
Just as I will not force upon my brother
The answer I have made to mine own doubt."

SCIENCE IN SEARCH OF GOD

CHAPTER I

THE NEW WORLD REVEALED BY MODERN SCIENCE

Prove all things; hold fast that which is good.

MOST of us take the world very much for granted. We have ceased to wonder at its marvels; we are not often confused by its complexities. Many of us were brought home from the hospital at the tender age of two weeks in an automobile, and we have been riding in motor cars ever since. The first artificial light that we noticed was the gleam of an electric bulb; the changing flashes of a Broadway sign attract our attention because of their beauty rather than because they express something of man's achievement in the utilization of the forces and resources of nature. Only the radio

and the aeroplane are so new that we marvel when we hear a symphony orchestra playing in a distant city or pause to gaze heavenward at the rush of silken wings.

With little realization of the contrast between America in the twentieth century and Palestine during the rise and fall of the Jewish Empire, it is not surprising that we find ourselves in great difficulty when we attempt to preserve such religious concepts as those which were developed in that ancient time and distant place. If Christianity or any other religion is to persist into the twenty-first century as a virile and significant force in human affairs, it must be related to the world as we know it and as our grandchildren will find it to be, rather than to the world as it was known to the philosophers of one or two or three thousand years ago. Whether we like it or not, the fundamentals of every religion are to-day undergoing the most searching examination they have ever had, in the light of the most brilliant and pitiless blaze that modern science can project. To understand

aright the revolution which has been accomplished in the minds of thoughtful men during the last few generations, one must comprehend the fact that the world of the pre-scientific age was utterly different from our world.

Take, for example, the description of their environment which would have been given by Moses or Joshua or any of the characters of earliest Jewish history. For them the universe was exactly what it appears to a casual observer to be. The earth was a flat platform, firmly established in the midst of the sea. Joshua had no reason to doubt that at some slight distance beyond the rim of the horizon were the corners of the earth, whence blew the winds. The starry vault of the heavens was just what it seems, a firmament solidly built like a great massive dome "to divide the waters." When rain fell, it was because the "windows of heaven were opened" and the water above the firmament was thus permitted to spill down into the space below. The sun and moon were merely "lights in the firmament," a "greater light"

for the day and a " lesser light " for the night. Each moved across the vault of the heavens from East to West, just as they appear to do. When Joshua had reason to believe that a particular day was of unusually great length, he very naturally assumed that the " sun stood still in the midst of heaven." Joshua's world was a tiny and simple affair, a vest-pocket universe.

In striking contrast is the universe revealed by modern astronomy. No longer do the stars look like specks of luminous matter hurled by a giant hand against a vaulted sky. Among them are the planetary associates of the earth in the solar system. Like the other planets, the earth moves in an elliptical orbit around the sun, keeping at an average distance of 93,000,000 miles from that glowing body which contains some 300,000 times as much material as the earth. In comparison the moon is a mere pygmy, only one-eightieth as massive as the earth, and only 240,000 miles away. It is not a " light " at all, but merely reflects the light from the sun. Instead of a " world so estab-

lished that it can not be moved," the earth is now known to be rushing through space at the rate of twenty miles per second in its haste to complete the circuit of its orbit in the lapse of time which we call a year. We all know now that the length of every day is determined by the speed of rotation of the earth upon its axis; have we not been so taught from our youth up? Although we frequently refer to the sun as "rising in the east and setting in the west," we know perfectly well that it does nothing of the sort, that the appearances which led to that assertion are a result of the earth's rotation rather than the movement of the sun.

It is not that modern science has taught us to distrust our senses. On the contrary, the very validity of the scientific method itself rests upon the assumption that our senses report to us quite accurately the nature of the world in which we live. Modern science has taught us to doubt the judgment of the casual observer, the hasty conclusion of the untutored mind. It has given us instruments of precision for the making of

measurements which displace the estimates of the unaided eye. Its telescopes and microscopes merely increase the efficiency of the lenses of the eye, its telephones and microphones merely assist the mechanism of the ear. Its records of the past and present merely give us vastly more data on which to base conclusions. Still is the world what it appears to be, but appearances no longer deceive us so completely as they once did.

Our world is a part of an orderly universe, a cosmos of well-regulated heavenly bodies, each of which moves in accordance with definite laws and specific regulations. It is far more difficult for us to think of the universe as a result of chance or accident than it was for the patriarchs of olden time, who with even their limited knowledge of its systematic orderliness saw in it the handiwork of God. The eight planets in the solar system, together with the scores of tiny planetoids, called asteroids, all move in orbits which are nearly in a single plane. If we should draw their paths to scale upon the ordinary schoolroom blackboard, each

orbit would look like a perfect circle, for the departure of the ellipses from circles is in each case so slight that it would be contained entirely within the width of the chalk line. Moreover, if we should place the sun at the center of the system, modeled to a scale which would permit the orbit of Neptune to appear on the blackboard, the relations of the various planetary orbits are such that all the members of the solar family could be placed within the board, a half inch or so in thickness. At no time would any of the planets come out in front of or appear behind the blackboard; only a few of the asteroids have sufficiently oblique orbits to permit them occasionally to move out of the narrow confines between the front and back faces of the board. Moreover, the solar system is so systematic that all of the planets revolve in the same direction around the sun, and all whose rotation is definitely known spin with forward rather than backward rotation. Nearly but not quite all the several satellites which like our moon pertain each to its own planet, revolve

about their controlling planets with motions which are forward rather than retrograde in reference to the planetary revolutions. Only two or three of the moons which belong to the outer planets break the regularity of the uniform direction of systematic motion.

Fixed though the sun is in respect to the earth and its fellow planets, it too is in swift motion through space. For it is but one of the many stars which form our stellar galaxy. So far as our observations go, the pathway of the sun is a straight line, but it is presumably moving in an elliptical orbit so tremendous that it would require centuries of swift flight at the sun's speed of twelve miles per second for any curvature to be apparent. Even as the members of the solar system move within a disc-shaped rather than a spherical portion of space, so the galaxy of stars is shaped like a very flat disc. When we look at the " Milky Way," our gaze is directed toward the edge of the disc; between us and the limits of the stellar galaxy in that direction there are many stars. When

we turn in any other direction we look toward one of the faces of the disc; between us and the "side" limits of the galaxy within which we live there are comparatively few stars.

Distances and dimensions within the stellar galaxy are literally beyond human comprehension. Though many of the stars are hundreds of times as large as the sun, space and energy rather than mass are the real characteristics of the galaxy. Light, traveling at the rate of about 186,000 miles per second, reaches the earth only about eight minutes after it leaves the sun, but the nearest star is so distant that its light leaves it four and a half years before it reaches our eyes. Many of the stars in the "Milky Way" are so distant that the light which we see twinkling in the heavens to-night left them en route to the earth when the northern states were still imprisoned in the great ice sheets of the Glacial Period, scores of thousands of years ago.

Presumably, many of the other stars have planetary families in their train, even as has the

sun, although it is the only star near enough for our telescopes to reveal the presence or absence of attendant planets. Our neighbor, Venus, is probably the only other planet in the solar system on which life, as we know it here upon the earth, could exist, but it is to be expected that the environmental conditions characteristic of the earth are approximated on hundreds of the many thousands of planets which are presumably in existence within the galaxy of stars. Nor have we any reason for concluding that life is limited to those creatures which can live only within the rather narrow ranges of temperature, atmospheric constitution, light, pressure, and other elements which together comprise the mundane environment with which we are familiar. Surely if vital energy displays such ingenuity in developing varied creatures to fit the varied environment which we know here upon earth, it is to be expected that living creatures may elsewhere be adapted to environments quite beyond the range of our experience,

environments perhaps in which no earth-born being could possibly exist.

Joshua's vest-pocket universe has expanded until it staggers even our imaginations by its size and splendor and possibilities. Nor is it a question of the imagination merely. The facts alone are sufficiently impressive. Beyond the limits of the stellar galaxy, other galaxies of stars are now known to dot the farther reaches of limitless space. So distant are they, that the giant suns which they include appear to blend together into nebulous wisps of luminous matter which can not be resolved into separate bodies by even the most powerful telescopes. Only by deductions from their spectra can we know that they are distant stellar systems. Some are so remote from us that it requires a hundred million years for light to traverse the intervening space. A universe, known to possess such magnificent distances as that, is scarcely less impressive than an infinite universe.

This great contrast between the world revealed by modern astronomy and the Old Testa-

ment concepts of geography and heavenly bodies is fully equaled when the modern biologic world is compared with that known to Joshua and his compatriots. The only animals and plants they knew were those native in the hills and plains of Asia Minor and northeast Africa. Vague rumors concerning strange monsters which inhabited the seas came occasionally to the tents and villages of the Hebrew patriarchs, but these were doubtless looked upon with skepticism by the conservatives of that day. The narrow limits within which opportunity for observation of plant and animal life was thus confined meant that only a few score of kinds of living creatures were known to Joshua. These were sharply differentiated species, easily distinguishable one from another, reproducing each "after his kind." There was nothing incongruous in the thought that a wooden barge could be constructed of such dimensions that it could shelter two of every sort of creature. Evidently the Hebrew patriarchs did not realize that plants are just as

dependent upon air as are animals. Had they understood the effect of prolonged submergence upon land vegetation there would presumably have been some mention in the story of Noah and his ark of the storage of roots and seeds.

How different is our knowledge of the world of plants and animals! From the jungles of South America, the arid tropics of Australia, the snow-covered summits of central Asia, the far-flung islands of the sea, strange creatures are constantly brought to enrich our museum collections and swell the already bursting flood of living species. A hundred thousand different species of beetles, nearly four thousand kinds of mammals, forty-five hundred species of ferns, a thousand kinds of deep-sea fishes, but start the huge catalogue which is daily increasing in numbers. All told, at least a million species of animals and plants are living in Our World, have been named by patient scientists, and are listed in scientific libraries.

As might be inferred, the task of classifying and naming this bewildering assemblage of

creatures is not the simple job which Adam had when he "gave names to all cattle, and to the fowl of the air, and to every beast of the field." But it is not the number of forms that makes the real trouble; serious difficulties arise when it is found that the sharp distinctions, which shouted aloud when only a couple of hundred animals were known, disappear completely when the roll is expanded. Animals and plants are not arranged in isolated compartments like the pigeonholes of the old-fashioned roll-top desk. Complete intergradations between "species" are constantly coming to light. Even the apparent gulf between the plant and animal kingdoms is now known to be bridged by creatures which are truly "plant-animals." No longer is the biologist able to give a satisfactory definition of the word "species." He now knows that the term connotes an artificial group selected from a continuous stream of constantly varying and perfectly blending individuals. Only when our knowledge of the organisms about us was far short of being truly representative was the "spe-

cies concept" a wholly satisfactory one. Today the cleavage between the "splitters" and the "lumpers" among biologists is nearly as subversive of good-fellowship as is the cleavage between "fundamentalists" and "modernists" among Christians.

To tangle still further the web of life, we now know that organisms do not reproduce as rigidly "after their kind" as was formerly supposed. At least eight thousand distinct varieties of roses have been produced from the mere handful of rose species with which florists began to work. Give a cabbage plant a "college education" and it becomes a cauliflower. Send a seedy orange to Luther Burbank's training school and the navel orange is developed. Pigeon-fanciers have produced from the wild dove a hundred varieties of pigeons, some of which are as unlike as the pouter and the fantail. The plasticity thus displayed by many kinds of animal and plant life adds a new significance to the command to man that he should "have dominion over every living thing that

moveth on the face of the earth." Modern knowledge of the world of living things gives an almost limitless opportunity to mankind.

An analogous leveling of barriers has marked the more recent progress of all our scientific thinking. Just as botany and zoology overlap when the protozoa and the protophyta are found to merge in the " plant-animals," so physics and chemistry join hands in the investigation of the intimate structure of the atom. As never before, science is impressing us with the essential unity of this universe which in spite of its name has seemed to many folk to have an essentially dual nature. Even this early in the development of the science of psychology it is becoming evident that the " natural history of man is the whole history of man." No longer is there a wide chasm between the natural and the supernatural, between the material and the spiritual. In spite of the handicaps of our vocabularies and the limitations of our mental vision we are being led inevitably into the ranks of the monists.

We do well to make such distinctions as those implied by the contrasts between matter and spirit, mind and soul, but those terms should not blind us to the fact that such contrasts are merely superficial or are imposed by the inadequacy of our own minds. They do not actually signify a fundamental cleavage of the universe into two interwoven "worlds." The dualistic philosophy which implied a conflict between rival administrators, God and Satan, or between spiritual ambitions and natural desires, was a product of the pre-scientific age. Just as we refer to the animal and vegetable kingdoms without contradicting the fact that all living organisms are manifestations of a vital energy which seems well-nigh limitless in its possibilities of varied expression, so we may retain the vocabulary of dualism and distinguish the material from the spiritual and still be true to monism with its concept of a universe in which the manifold realities of which we are now aware are still inadequate to express all the capabilities of creative energy.

Man is not a creature from another plane or sphere, spending a small fraction of his existence in the strange environment of the earth, playing a brief rôle as an actor on a foreign stage before entering the environment for which he is truly fitted. He is distinctly an offspring of Old Mother Earth; this is his home; here is his natural environment.

Joshua's World was made expressly for man. Everything in it was designed especially to contribute to his welfare or to punish him when he incurred the displeasure of his God. He occupied the summit of the tall pinnacle of superiority, not because he had won his way to that proud eminence, but because he had been placed there by the Creator. The locality where he lived was the center of the universe; sun, moon and stars revolved around him in it. Joshua's concept of man's place in nature has lingered long in the minds of his descendants; echoes of that concept are still with us. Did not Linnæus give the name "Primates" to that order of mammals which he defined as including man?

But Our World is not so flattering. "What is man that thou art mindful of him?" has a new meaning since Betelgeuse was measured. In geologic time, man has lived for but a moment in the earthly day. In astronomic space, he is a speck of foam on the crest of a single wave in the midst of a Pacific Ocean. The earth is neither the smallest nor the biggest, the hottest nor the coldest, the most central nor the most remote among the planets of the solar system. Presumably there are many other similar bodies in the heavens. Except for the fact that you and I are on its surface, there is nothing especially distinguished about it. The sun is just an ordinary star. There are many larger, many smaller; many hotter, many colder; many brighter, many duller. Presumably many of its neighbors in the heavens have fully comparable planetary dependents of their train. The stellar galaxy is but one of the many far-flung aggregates of stars. So far as we are aware, it may be duplicated many times in space. Only our presence for a brief span of years upon this

insignificant earth gives importance to one particular star in one of many galaxies of stars.

There is no reason for assuming that human life is the most superior expression of the vital impulse which the universe has yet achieved. It is scarcely likely that the Administration of the Universe has staked all on this one type of life in this one locality. Perhaps on some distant planet the achievements of the Universal Spirit far outstrip anything that man has yet attained. But for us, Our World in this particular geologic epoch gives The Opportunity. It is Man's hour; the prize is almost in his grasp. Dominion over his fellow-creatures is for all practical purposes his; mastery over the forces of inanimate nature is well-nigh assured; only Self, individual and aggregate, remains to be subdued. Our World is not a furnished stage on which the puppet man enacts a rôle; it is a challenge to the best in man to overcome all handicaps and emerge successful in the attempt to achieve a truly satisfactory life.

In Joshua's World anything could happen.

Magic played a most important part in every-day life. Happenings were determined by the caprice of ruling powers whose whims and intentions varied from day to day. Ours is a world of law. Effect follows cause with unvarying relations. Order and regularity reign where formerly magic and caprice held sway. The law of gravity operates relentlessly, the same yesterday, to-day, and to-morrow, regardless of bribe or entreaty.

In the pre-scientific world the forces of nature were under the direct and immediate control of supernatural beings who used those forces to wreak their vengeance upon certain unfortunate or guilty individuals or to add to the physical prosperity of their more fortunate or more "righteous" brethren. Jove hurled his thunderbolts with deadly accuracy upon any human being who incurred his displeasure. Jehovah drowned all the men and women he had made, except Noah and his family, because of their wickedness. Sodom and Gomorrah were destroyed by fire and brimstone rained out

of heaven because not even ten righteous men could be found in those cities. On the other hand, the gods made easy the path of those whom they favored; with gentlemanly kindness they overlooked the shortcomings of their favorites. Food was magically supplied in a barren wilderness, even though the chosen people ofttimes strayed from the path of righteousness. The penalty for "him that sinneth through ignorance" was different from that for "the soul that doeth ought presumptuously."

But Our World plays no favorites. The rain falls alike upon the just and the unjust. Volcanic eruptions and earthquakes result from the operation of inflexible natural laws * which can not be changed in the slightest by the morality or immorality of the human inhabitants of the locality. To be sure, in 1906 there were a few suggestions from certain pulpits of the land that San Francisco's tragic earthquake was a

* There is, however, much misunderstanding concerning the inflexibility and universality of "natural law"; this subject is therefore given more extended consideration in chapter 5, beginning on page 106.

just retribution for the sins of its citizens, but that only bears out the observation that long-treasured ideas die hard. Few people nowadays would claim that great wealth and material prosperity are an indication of righteous conduct, while poverty and want are the customary accompaniments of violation of the moral code. Experience indicates unmistakably the fact that ignorance of the law excuses no man. Lack of knowledge of the relation between the anopheles mosquito and the germs of malaria does not protect the ignorant from the ravages of that disease.

The automobile is symbolic of Our World. It goes, or refuses to go, without any reference to the piety or volubility of its driver. Unless there is gasoline in the tank, oil in the motor, electricity in the battery, unless every necessary connection is made, the proper switches turned, the right adjustments made, it will not start; nor will entreaties, prayers, or profanity make any difference with the machine. It matters not whether the occupants of the car are

en route to a petting party at a roadside inn or are on an errand of mercy to cheer a loved one in a city hospital, the mechanism operates just the same, in accordance with the purely mechanical principles on which its effectiveness depends.

But the symbolism does not stop there. The automobile is an entirely useless mechanism unless it is occupied and controlled by a conscious organism. The unconscious machine is useful and valuable because it obeys the motions of the man at the steering wheel. The driver is just as important a part of the symbol as the motor or the battery. Even as the motorist is responsible for the activities of his car, so is mankind collectively in charge of Our World. He can drive it whither he will. The responsibility rests fairly and squarely upon human shoulders. If the driver is drunk, crazed, ignorant or asleep, the machine will end in the ditch; if he is clear-eyed, intelligent, alert and careful, disaster can be safely avoided.

Our World is vast, beautiful, and impressive;

yet are we not satisfied with it. We know that there is much room for improvement; we yearn for a better world in which all men may have more abundant opportunity to live a more truly satisfactory life. If our symbol holds good, two things are prerequisite to the attainment of that better world. We must know the regulations which control the mechanism so that we will have full power over the machine; we must select the right goal toward which to steer Our World and find the right road thither. The first involves the training of the human intellect and the extension of the scientific method of research until all the intricacies of our physical environment are discovered. The second involves the training of the human heart and the extension of the spirit of brotherhood until all our selfish interests are subjugated by the desire for the welfare of all men everywhere. Neither the trained intellect nor the loving heart can " save the world " alone; both are needed, else humanity must fail. The problems of life are not yet solved. Still do we

know only in part. The new world revealed by modern science flings a challenge to meet which man must summon every resource of mind and heart and soul.

Among these resources none is more interesting than that which has made modern science so efficient an agent for the utilization of natural forces and material resources. In this New World the scientific method stands approved, vindicated by experience; unless it is applied to the problems of religion, the theologian can not expect to make any permanent gains in the midst of modern civilization.

The scientific method involves certain specific habits of mind, a particular intellectual attitude toward the universe. When a man of science approaches a problem he expects to make use of certain principles, among which is the principle of causal relations: for every effect there must be an adequate cause. There is also the principle of uniformity in nature: the same forces operating upon the same things under the same conditions will always produce

the same result. And possibly most effective of all is the principle of multiple working hypotheses: in attempting to discover the real cause of any observed condition or effect, every possible explanation should be given full consideration. Sometimes a lead which appears at first glance to be hopeless, when followed clear to its end is the clew to the problem's solution.

The man of science never considers any problem as finally closed. The " last word " has never yet been said about anything. Conclusions reached and laws formulated by one set of investigators are always subject to renewed inspection and critical study by any other group of scientists. To have the product of one's own research critically examined by another is no indication of disrespect; it is rather a mark of highest honor. On the other hand, when the scientist finds that a large number of observable facts of nature are explained by a reasonable statement of a process or a relationship, and especially if many facts not known when that statement was formulated are later found to be

in harmony with it, he feels he has a right to place great confidence in that statement as a true one. Thus he has come to respect a great number of so-called theories and natural laws. His belief in them, once firmly established and amply justified by observations and experiments, is not easily shaken.

The search for knowledge in that frame of mind has been richly rewarded. Nature seems ready to reveal her choicest secrets to the patient and humble investigator. Knowledge thus gained his made man powerful. The last half century has witnessed remarkable progress in the task of " subduing the earth." The practice of these scientific habits of mind has literally revolutionized the world.

But the scientific method is really nothing new. Its use, albeit faltering and rare, dates back beyond the dawn of recorded human history. Huxley's instructions to the investigator, " Sit down before a fact as a little child; be prepared to give up every preconceived notion; follow humbly wherever and to whatever

abysses nature leads," were paralleled by the thought in the mind of Jesus long ago, when he remarked, "Let the children come to me; do not try to stop them, for the Kingdom of God belongs to such as they. I tell you, whoever does not accept the Kingdom of God as a child shall not enter it at all." The scientific principle of multiple working hypotheses is but a practical application of the advice which Paul sent once to his followers in Thessalonica: "Prove all things; hold fast that which is good."

It is in such an attitude as this that man must summon the newly gained knowledge of his material environment to aid in solving the manifold problems inherent in his lack of knowledge of the spiritual phases of the world in which he lives.

CHAPTER II

SCIENCE AND RELIGION: ARE THEY FRIENDS OR ENEMIES?

The dust of controversy — what is it, but the falsehood flying off?

THE recent wave of opposition to the teaching of evolution in American schools and colleges is in part caused by the fear that science and religion are enemies rather than friends. The attack upon science has all too often been based upon ridiculously unsound premises, but the belief that something is wrong with science must nevertheless be carefully considered. Mr. Bryan voiced the opinion of many persons when he exclaimed at Dayton, Tennessee: "You must choose between evolution and Christianity; you cannot accept both." To many,

the advance of science presupposes the retreat of religion.

At first glance, history appears to support that conclusion. Time and again, in the progress of civilization, scientists and theologians have joined issue concerning some point of fact. Does the earth revolve around the sun, or does the sun actually move across the " firmament of the heavens " from dawn to dark? Is man a result of evolutionary processes by which he has developed from other forms of animal life, or was he manufactured in a few hours from a lump of clay? A Galileo is hailed before the Sacred Congregation of the Index at Rome in 1633; a John Scopes is summoned into a District Court at Dayton, Tennessee, in 1925. Whatever may be the verdict of the particular time and place, the abiding judgment of thoughtful men everywhere is in favor of the scientist. With monotonous regularity the world discovers that science is right, that theology is wrong. Does this set the precedent for the future? Must religion retreat ignominiously until it is pushed

completely into the discard by an advancing and victorious science?

The experience of the past does indeed suggest the trend of the future, but when the theologians have been thus defeated it was because they fought not as the champions of real religion but as the defenders of an outworn and faulty science in the face of a new and truer science. The cardinals at Rome in 1633, Mr. Bryan and his colleagues at Dayton in 1925, were not defending Christianity against its enemies; they were the champions of the science which was current in about the year 1000 B.C. in the countries bordering on the eastern Mediterranean. A theology which believes its chief mission in life is to preserve tradition rather than to discover truth is a static theology; it is bound to fall before the advance of dynamic science.

The history of every great religion shows a definite development and modification of the theological and philosophical concepts which it cherishes, because no great religion could

possibly be stationary. It must be moving forward, keeping abreast of the ever-moving current of human thought. In Roman Catholicism, for example, there has been noteworthy progress along these lines, in spite of its conservatism and its respect for tradition. It was, of course, the leaders of the Roman Catholic Church who demanded of Galileo a retraction of his statement concerning the movement of the earth and who caused Bruno to be burned at the stake because he would not renounce newly discovered and greatly cherished scientific principles. But that happened hundreds of years ago. To-day, the Roman Church takes a very different attitude toward evolution. Formerly, Roman Catholicism acted as though its faith depended upon the belief that the earth is the fixed and immovable center of the universe; to-day Roman Catholicism takes an absolutely impartial view toward evolution. There are individual priests, here and there, who affirm that evolution is anti-Christian; but the leaders of that great sect make no pro-

nouncement either way. They say, and say wisely, that it is none of their business, that it matters not a whit to the Catholic faith whether evolution can be true or false. In the Roman Catholic Church there are many great institutions of learning, the faculties of which include hundreds of skilled teachers of science, many of whom accept evolution as a demonstrated principle. The position which this large group of Christian folk take to-day is a perfectly logical one.

The modern attack upon the scientists comes not from the Catholic, but from the Protestant. There are a number of Protestant denominations, not nearly so wise, perhaps because not nearly so old as the Roman Church, who rush blindly, although very boldly, into the breach and announce that no one can accept the findings of modern science and at the same time keep his faith in God.

The reason for that pronouncement is obvious to the historian. Protestantism started as a wave of opposition to the Roman Catholic

dogma that there is one infallible spokesman for God, that the Pope by virtue of his office holds the keys to heaven, that his official utterances are clothed with Divine authority and are to be accepted unquestioningly as inerrant. Protestantism affirmed that no human being is infallible; that there is no single individual through whom men must make their approach to the Divine Spirit. At first, when the Protestant denominations were starting upon their notably victorious career, they upheld no infallible authority to take the place of the infallible Pope who thus for them had been set aside. Responsibility for the discovery of religious truth was placed quite frankly upon each individual. The founders of Protestantism looked upon the Bible intelligently as a collection of many books, the values of which were by no means the same. But men curiously hesitate to trust their own judgments; they generally want to place the responsibility for a decision upon some other person or thing. A flip of the coin, blind choice of a verse of scrip-

ture, the advice of a friend, are preferred to one's own reasoned judgment. In religion especially do men crave an absolutely sure authority, and very soon, in the history of Protestantism, an Infallible Bible began to take the place which had been occupied by an Infallible Pope. Thus the Bible came to be known as the Word of God, an inerrant source of instruction in all matters, secular or religious, upon which it touched. Its science as well as its philosophy and ethics must be defended as of Divine origin or inspiration.

With that view of religious authority, science can make no peace. The description of the external world which was satisfactory to the writers of the more ancient portions of the Old Testament is now known to be faulty and inadequate. The science of Genesis is in complete opposition to the science of the Twentieth Century; no amount of quibbling over the meaning of terms can harmonize the two. But the majority of intelligent persons nowadays have a fairly good understanding of the real nature of

the Bible. It is not a book, but a collection of books. It is a library of religious and historical documents written by different individuals at different times for different purposes.

Some of these documents are clearly allegorical and were never intended by their composers to be taken literally. When a man talks or writes about a "tree of knowledge of good and evil," he is obviously using a figure of speech; he is not referring to any particular species of fruit tree, apple or otherwise. Similarly when he describes man as formed of the dust of the ground and receiving from God the breath of life, is it not likely that he is thinking crudely of the fact that man is a creature of mixed nature: of the earth, earthy; but capable also of great spiritual development? To take the allegory and the parable, the figure of speech and the picturesque romance of the Bible as literal statements of fact is to do that volume a great injustice.

The chronologic succession of the many documents interwoven in the Bible reveals unmis-

takably the evolution of one great type of monotheism. For example, in certain parts of this library there are specific directions as to just how burnt offerings should be prepared, just what garments should be worn, just what ritual must be followed, just what environment must be entered in order to commune with Jehovah. Then in contrast to that archaic idea of what God expects of men, there is a great prophet who asks, "What does the Lord require of thee, but to do justly, and to love mercy and to walk humbly with thy God?" There has been a change from one type of religion based on formalities and rules, to another type of religion based on mode of life and relations to one's fellowmen.

Or again, the stories of creation in Genesis reveal something of the ideas which men at one period of Jewish history had concerning the relation of God to man. Why was it that Adam and Eve were sent forth from the Garden of Eden? According to the popular notion it was because they had broken a regulation when they

partook of the fruit of a prohibited tree, and as punishment for thus breaking the law they were sent forth from the Garden. But the last three verses of the third chapter of the Book of Genesis tell a very different story and give a most revealing flash of insight concerning the patriarchal estimate of Jehovah. "And the Lord God said, Behold, the man is become as one of us, to know good and evil; and now, lest he put forth his hand and take also of the tree of life, and eat, and live forever: therefore the Lord God sent him forth from the garden of Eden, to till the ground from whence he was taken. So he drove out the man; and he placed at the east of the garden cherubim with flaming swords which turned every way, to guard the way to the tree of life." In striking contrast is the voice of the humble Carpenter of Nazareth, "I came that ye might have life and have it more abundantly." "For God so loved the world that he gave his Son that whosoever believeth in him should have everlasting life." Ancient Judaism had evolved into Christianity;

monotheism was facing forward, progressing with the expanding and advancing minds of men.

Nor should we think that revelation was completed when the last documents in the Bible had been compiled. John of Patmos was not the last inspired writer the world has seen. Witness the biblical record itself. "Ye shall know the truth and the truth shall make you free," not "I have here given you all the truth, and you are now free." "When he, the spirit of truth, is come, he will guide you into all truth;" not "I have told you everything you need to know and all is now revealed." The Biblical scriptures are but a part of the greater library which records the success with which men have discovered the nature of the universe, the character of spiritual energy, the qualities of life.

But this is only a small part of the problem under consideration. If we grant that it is the business of theology primarily to discover truth and only secondarily to preserve tradition, we

cut through the temporary and trivial conflicts to the fundamental relations between science and religion.

Science has as its goal the complete description of the universe in which we live; religion seeks to find the most abundant life which man may possess in such a universe. Geology is a collection of beliefs and ideas about the earth; it deals with facts and experiences pertaining to the transformations of material objects when acted upon by such forces as gravitative attraction and electromagnetic impulses; it strives to interpret aright the world of sense perception, of which we are so constantly aware. Theology is a collection of beliefs and ideas about the mutual relations between God and man; it should deal with facts and experiences pertaining to the higher reaches of human life; it must strive to interpret aright the spiritual realities of which adventurous souls are abundantly aware.

Theology and religion are distinct one from the other, even as are scientific theory and scien-

tific research. All four are quite necessary to human welfare, but each has its own prerogatives and responsibilities. Theology concerns beliefs, just as do the theories of physical science. The philosophy of religion deals with concepts and ideas; every theologian must have some sort of religious philosophy because belief involves the commitment of oneself to concepts that seem satisfying. But religion is a practical rather than a theoretical affair; it deals with a "way of life." Similarly, in scientific circles it is not unusual to distinguish between "pure" and "applied" science. Both make use of the laboratory, but one seeks merely concepts and ideas satisfactory enough to merit the allegiance of one's belief in their truth, while the other seeks to use the knowledge thus gained for the improvement of the conditions under which human beings live.

The most inspired men of religion, if we may rate the quality of their inspiration by the permanency of their influence, have been characterized by scientific habits of mind. They

have looked to nature to discover nature's God. "Consider the lilies of the field; behold the fowls of the air." Not mere rhetoric; but absolutely sound advice. The Master Teacher used those phrases because he meant just what he said. If one understands plant and animal life, one will be led through that understanding to a new comprehension of the nature of the Power which is partially displayed in that sort of life. But these leaders in the field of religion have been wise enough to base their teachings on spiritual realities rather than on current descriptions of the material universe. Jesus, for example, did not commit himself concerning the principles of Meteorology, although there were many contemporary debates about the nature and origin of the wind.

The theologian must use the scientist's description of physical phenomena as an aid in discovering the higher values of life. It is the business of theologians to-day just as it was the business of Moses, Elijah, or the Christ, to take the best description of the physical world, which

the keenest observers and most rational thinkers of their day could offer, and to give to that description the spiritual interpretation needed that men may properly evaluate the forces operating in the universe. The development of theology is therefore intimately related to the expanding knowledge of the material universe which has marked the more recent evolution of man.

From one point of view it is true that the scientist and the theologian ought to remain each in his own territory. Beyond doubt much of the apparent conflict between science and religion has been due to the failure to comprehend the distinction between these two fields of thought. Nevertheless there is a broad area in which they necessarily overlap. How can one tell what is the most abundant life unless one knows the nature of the universe in which that life must be lived? How can one get a satisfactory religious motive and outlook for life in a physical world without understanding the nature of that physical world? Somehow

religion must be related to the life which we know through observation and experience; and this life is certainly a part of the field of natural science. We must discover how the mind of man operates in order to learn how the soul of man may grow. We must know the regulations of physical life in order to reach out and upward into the realm of psychical life. Science and religion are too intimately related to permit any barrier to be erected between them.

Unfortunately, many persons refuse to appraise them similarly. Science, in its discovery of the regulations of the physical world, is proclaimed as going forward victoriously day after day. But as a matter of fact nearly every victory for science means necessarily the overthrow of some previously cherished idea which scientists had held. The quantum theory and the Einstein theory bid fair to destroy or greatly modify certain principles which physicists have long held. But no one ever considers this revolution in physical science as anything except a great victory.

Similarly, if the theologian must also have his face toward the future, if he must be discovering truth, then necessarily his progress involves the rooting out of error, the abandonment of ideals long cherished. He too must destroy in order to construct; he too must break down the old in order to build the new. But strange though it seems, if theologians announce that a concept long cherished in the annals of religion is no longer acceptable because of newly discovered facts or a new understanding of experiences, most people conclude that this is "just another defeat for religion."

This is obviously unfair. When a theologian abandons a formerly acceptable belief concerning the nature of the Administration of the Universe because he finds it incompatible with new information concerning operations within the universe, it should no more be reckoned a defeat for religion than the development of the quantum theory should be hailed as a defeat for science.

That of course implies that the creeds and

dogmas of religion are milestones which mark the progress of our discovery of the real nature of God, and the true relations between man and God. They originated as statements of belief, interpretations of facts and experiences. Although they were based upon life, they have become for many persons mere words to be repeated glibly and thoughtlessly. To understand them aright we must focus our attention not on their phraseology, but upon the experiences and facts which brought them into existence.

Often those experiences were interpreted in the light of the contemporary beliefs concerning the physical world. With the advance of science, new interpretations are necessary. Frequently the great truths of religious philosophy have been so closely associated in the minds of churchmen with the faulty description or incomplete understanding of natural phenomena possessed by ancient prophets, that the advances of science have seemed to be just as much a blow to those truths as to the concepts of nature

with which they were associated. On the contrary, the result of much scientific discovery has been to affirm anew the validity of many of the truly fundamental doctrines of theology and to impress upon mankind more forcibly than ever before the abiding value and true satisfaction of the richer type of life implied by a rational religion.

In both science and religion there is need for the ever recurring cycle in which the prophetic mind is followed by the priestly mind. Flashes of insight into the nature of the world and of human existence are gained by the prophets. Then they are crystallized into phrases by the priests. To the prophet goes the credit of leadership in discovery; to the priest goes the credit for preserving the knowledge gained by the prophet. Ever and again, new prophets must arise, both in science and religion, to burst the confining walls of inherited orthodoxy and blaze new trails to higher vantage ground.

It is only natural that the priests of science,

as well as those of religion, should cling to the dogmas of the departing generation and accept but slowly the discoveries made by the contemporary prophets. As a rule the average scientist is more ready to welcome new knowledge and new interpretations than is the average theologian, but there is still much room for improvement. For example, the mechanistic concepts which seemed so satisfactory to the scientists of a decade or two ago are even yet deeply entrenched among the cherished dogmas which clog many modern minds, in spite of the completeness with which the contemporary prophets of science have replaced the idea that the universe is only a mechanism by the idea that it is more correctly described as an organism.* In other words, there is at present just as much need for the reform of the science possessed by the "man in the street" as for the reform of his religion. Doubtless one task is about as difficult as the other, and fortunately both are to-day being undertaken courageously by many

* See chapters IV and VI.

capable individuals. In both science and religion, new facts are being apprehended and new interpretations of age-old experiences are being made.

As one considers the evolution of religion it is well to note that however firm may be its foundation on facts and experiences, there needs must be not only new statements of old truths, but also the radical modification of ideas to fit the new experiences of the race. Every experience is real, and therefore true; only beliefs about experiences may be true or false. The test may be applied only by the great experimental method of science: what is the result in human lives of the particular belief undergoing appraisal? By their fruits may the doctrines of theology be known.

Here especially the theologian needs to adopt the methods which have proved so successful when used by science in its interpretation of nature. An interpretation which seems satisfactory only to one individual, when many have the same or a similar experience, must be looked

upon with considerable skepticism. Experiences may be accepted as correctly interpreted and rightly understood when a particular belief about them seems satisfactory to a large number of thoughtful men who are in a position to pass judgment upon that belief. Science has learned to distrust not merely the hasty conclusion of the untutored mind, but also the biased conclusion of an individual who has already committed himself regarding similar problems. Realizing as we do how difficult it is to understand correctly the nature of the external world of sense perception, it is necessary to take every precaution when we attack the still more difficult task of interpreting the mystical experiences of the human spirit.

Because the normal human mind is inherently rational, at least in some degree, such tests have always been applied to religion. In consequence, we find that every great religion has centered around a great personality. Theology in the abstract, however rational it may appear to be, has little appeal to the average man. But

theology made vital in the life of an individual is one of the most powerful forces in the universe.

The evolution of religious philosophy is keeping pace with the expanding knowledge of the material universe. Therein is indicated the abiding nature of spiritual realities. Because men dare to stake their lives upon the correctness of their beliefs concerning the nature of the universe and the character of its administration, mankind will survive in the struggle for existence. That struggle is by no means ended because we have bread and clothing, automobiles and aeroplanes. The real problems which we have to face are in the realm of the spiritual rather than the material, the psychical rather than the physical. There are crises in the evolution of life before mankind as well as behind him. To win through to the truly satisfactory life of which the prophets have dreamed, man must summon every aid which can come to him from religion as well as from science.

CHAPTER III

THE SEARCH FOR GOD IN A SCIENTIFIC WORLD

Earth's crammed with heaven,
And every common bush afire with God,—
But only he who sees takes off his shoes;
The rest sit 'round it and pluck blackberries.

IN the greatest drama of Hebrew literature, Job voiced the eternal cry of humankind when he exclaimed, "Would that I knew where I might find God!" The college student of to-day usually expresses the same thought in the query, "Is there a God?" Perhaps the real question in the minds of modern men and women is more accurately phrased if we ask, "What is the nature of God?" The attempt to discover the character of the administration of the world in which we live is apparently as old as human history and as widespread as human geography.

Primitive peoples, whether in ancient times or in places remote from modern civilization, have quite generally assumed that supernatural beings dwelt in every object which they saw. Each tree or river, mountain or valley, rock or swamp, had its own spirit or soul, which might prove either vindictive or helpful toward man. A boulder which rolled down a steep hillside and crashed through a man's hut, did so because the being or spirit residing in that boulder was for some reason offended by the person whose property was thus destroyed. The spirit of the river must be bribed or placated, perhaps by a human sacrifice, in order that in flood-time its waters would not sweep away the village. Or more powerful, friendly spirits must be summoned by incantation or burnt offering to subdue or disperse the spirits whose wrath against men had been aroused unwittingly or who were constantly and naturally determined to make human life unpleasant and difficult. That answer to the question concerning the nature of God is called animism. Inanimate objects were

believed to be really animated by some unseen power; everything was imagined to possess an "anima," that is, a soul or spirit.

In a scientific age, such concepts of the nature of the uuniverse are rightly looked upon as ridiculously naïve and wholly unsatisfactory. Even so, there are many relics of animism in our modern life. A little child who stubs his toe upon a rocking-chair, scolds the chair for being in the way; and grown men have occasionally been known to curse the door against which they have bumped their heads.

But with the progressive discovery of the facts of nature and more extended consideration of human experiences, rational minds soon saw the inconsistencies in the animistic answer to the question concerning the character of the administration of the universe. If there were many independent spirits, each one absolutely free to do just what it pleased, there could be no harmony in the world. Instead there would be anarchy, and it does not take a very high degree of intelligence to discover that although

there is occasional conflict between the various units in our surroundings, there are also a smoothness and regularity of operation which necessarily bespeak the harmonious nature of the universe. Out of the animistic conception there naturally developed the thought of one supreme administrator, the all-powerful overlord who ruled the lesser spirits and thus brought order out of chaos. Under his direction, the mob became a well-drilled army.

Primitive Judaism and medieval Christianity gave much the same answer to the question concerning the nature of the administration of the universe. God was a person of majestic power, residing high above the earth, who was in direct and immediate control of all things which happened on this lower level. Having made the world and all its inhabitants, he had withdrawn from it and was now watching from above. When he pulled the strings, the puppets danced; occasionally he stooped down to make an adjustment in the machinery. If something went wrong, down here upon this earthly plane, the

only recourse for suffering injured humanity was through appeal to the remote power, high above in inaccessible distance. The appeal might be phrased in magic words, or it might be strengthened by burnt offerings. It might be fortified by ritual or ceremonial, but man could do nothing more; the power to change the mechanism resided wholly in its maker. When God became ready to act, things would be changed; man was helpless and could only await the will of God.

That answer to the inquiry concerning God is technically known as deism. God is the transcendent Creator, but not the immanent Administrator. His task is finished or his labors have wearied him, so that he is now resting in some distant place, entirely outside of his creation. Only occasionally does he intervene and alter the operations of the world mechanism.

But modern science has scanned the heavens with its telescopes and has reported that there is no place where the deistic God may dwell. In a scientific age we know that everything hap-

pens in an orderly way in obedience to law; there is no outside interference whatsoever. Every effect is produced by an adequate cause, discoverable within the universe; every cause is followed by its effect. Deism is to-day absolutely unsatisfactory to the man of science. But so also is it to the intelligent man of religion. If God is deistic, all-powerful, and in direct and immediate control of affairs, how can he, at the same time, be all-wise and all-loving? Why does he permit the suffering and sin, the unhappiness and distress, which is so obviously a part of the life which we know? There are, of course, many ways which have been used by theologians to extricate themselves from this dilemma, but they are too devious to be satisfactory. For the most part they are a tribute more to the cleverness than to the wisdom of their authors.

Dissatisfied or even repelled by deism, many persons proclaim themselves as atheists. Most of modern atheism is merely a reaction to this particular idea concerning the nature of God.

Still does the heart of man long, as of old, for an answer to its fundamental need. In this perplexity, it is not surprising that an appeal should be made to science for aid in the search for God. Surely, if science has been so successful in discovering the facts of nature, it ought to have something to say concerning nature's God. It is reasonable to hope that the method of research which has proved successful in revealing the secrets of the material universe ought to prove of value also in the study of spiritual realities. Granted that the man of science has to go outside of his own field and even trespass beyond the pale of natural science, he is somehow expected to have peculiar aptitude for making the venture out into the unknown, where there is neither path for our guidance nor ground for our feet to tread.

We ought, however, to be fully aware of the limitations not only of the individual scientist, but also of the method which is fundamental in every scientific research. That method is the method of analysis, a method which has abun-

dantly proved its worth, but which has nevertheless very definite limitations. Stand with the geologist on the brink of the Grand Canyon of the Colorado River at twilight and watch the shadows deepen. The brilliant hues of vermilion, carmine, crimson, orange that splotch the sculptured canyon walls, fade and change. Gradually they become deep blue, purple, almost black, and the Colorado River is just a silver thread, barely visible a mile below our feet. Then twilight becomes darkness and you stand alone in the midst of space—the chasm, apparently bottomless, below you, utterly black; the stars, apparently at an infinite height above you, startlingly bright. The geologist might analyze that scene and tell you that the rocks in the bottom of that canyon belong to the Archeozoic era, that upon them rest the Algonkian formations, and then, in order of succession, the various strata of the Paleozoic age. The chemist might take those rocks and determine the composition of each mineral which gives such brilliant, vivid hues to the landscape. The

physicist might use his surveying instruments to measure with precision the depth to the river below, to note the angles of the sculptured temples and massive buttresses on the canyon walls. Thus we might gather a great mass of data contributed by patient scientists as a result of analysis in the particular field in which each is an expert. Do you suppose that this consummation of data concerning the Grand Canyon of the Colorado would mean to some friend in a distant city to whom you might send it, one thousandth part of what the Grand Canyon meant to you as you stood there? Could it convey to one who studies it any conception of the value of the scene to you who had witnessed it with an increasing sense of wonder and of awe? However complete may be the chemical and physical analysis of a great work of art, whether it be the sculpture perfected by human hands or by hillside rivulets, such a description is wholly inadequate to explain its beauty, its charm, its influence upon the lives of those who see it as a whole. Mathematics to the contrary

notwithstanding, the whole is often greater than the sum of its parts.

Nevertheless, analysis has its values and is a help toward the solution of most problems. Knowledge of the geology, the physiography, the chemistry, and the physics of the Grand Canyon adds to our ability to profit by its beauty, to respond to its influence. Similarly, analysis of the physical universe gives a basis from which to start in the search for God. To the physical chemist, matter consists of molecules formed by the union of two or more atoms. A few years ago it was believed that the atom was the incompressible, indivisible, and indestructible unit of the material universe. No one had any rational ideas as to how atoms came into existence or what really determined their activities after they had come to be. To-day, the structure of the atom is partially known and our scientific concepts have radically changed. The atom is composed of electrons and protons, and these are in all likelihood nothing but negative and positive charges or units of electrical

energy. The apparent mass, form, and weight of objects are due to the number and arrangements of the electrons and protons within the atom and to the high velocities at which these units of energy are moving. In other words, the atom is fundamentally an aggregation of swiftly moving units of energy. From this is derived a modern definition of matter, which though somewhat facetious is nevertheless true: "Matter consists of tiny particles of nothing, moving very swiftly."

The philosophical implications of this analytical view of the universe are obvious. The world of sense perception is a manifestation of energy. There is "something back of the universe." Matter is neither eternal nor ultimate; it is a temporary and local expression of energy. If there is anything which is ultimate, eternal, absolute — and our minds somehow seem to expect that there is — that something must be energy. Analysis seems to lead inevitably to the conclusion that energy is the ultimate reality, the eternal verity. Could we know its na-

ture in its entirety, we would have at last the complete answer to the quest of Job.

Here again we turn to the methods of science. How did the scientist discover that there were electrons in the atom? No man ever saw an electron; yet every well-trained scientist is ready to stake his reputation on the fact that electrons are. He knows that electrons are, because he has observed what they do. The results of their activities indicate their nature. Radio impulses are speeding through the air all 'round us, most of the time, whether we are aware of them or not. Although they are quite imperceptible to human senses we become aware of their presence when proper mechanisms are provided to catch them in motion and translate them into sounds which are audible to the human ear. We know that this particular sort of energy is a reality, because of its effects upon certain forms of matter. Even so the nature of Eternal Energy, the Ultimate Reality, may be discovered by observing what it does.

Once more, caution is necessary. We have

no right to assume that the manifestations of energy which are to-day perceptible to our senses are all the possible or actual manifestations of energy. Our results again will give us only a partial view of the whole. But that partial picture is a tremendous help. The zoologist tells me, for example, that my eye is a response to something in the environment. That which we call light rays, coursing through space, has impinged upon sensitive protoplasm, the stuff of which all living bodies are made. As a response to this external stimulus the splendid mechanism of the human eye has been developed through the evolutionary process during geologic time. Similarly, the human ear is a response to the external world. That which we call sound waves, pulsing through the earth's atmosphere, impinges upon sensitive protoplasm, and the delicate mechanism of the ear, far better in some other animals than in man, but still pretty good in man, is the result. But the evolutionist cannot stop there. Man possesses other attributes than those of his body

alone. His yearning for truth, his appreciation of beauty, his desire to make his own life worthwhile in the world, his sense of values, in short the various attributes which we say pertain to his soul, are just as real as eye or ear. They, too, must be a response to something in his environment. That which we call the spiritual, permeating the universe, impinges upon sensitive protoplasm in the form of a quadruped mammal who stands erect and uses his front limbs as arms and hands, and the human soul, not nearly so perfect as it some day may be, but still pretty good in the best of men, is the result. The causes must be adequate to produce the effects; the antecedents cannot be less than the consequents. To explain humanity at its best, the evolutionist must ascribe to the universe those qualities which we do well to call divine.

For man, a product of the energy which fills and thrills the universe, is different from other organisms. He is of course an animal; but there are many grades of existence and man seems to stand alone upon his own level. He is

unique, in ways which can be discovered only by observation, experiment, and experience, not by any process of *a priori* reasoning. Nothing concerning man can be taken for granted as a result of observation of other animals. When the cow pauses on the hilltop at sunset to admire the view, or the dog ceases baying at the moon to construct a system of astronomy, we will welcome the cow and the dog into the category of rational aesthetic creatures, in which category man is rightly placed. Somehow, out of the continuity of the process, real differences have emerged. Even though we may not understand how these differences arose, the facts are there. Knowledge and mystery have a habit of existing side by side; but mystery does not invalidate the fact.

Thus in a scientific age the search for God leads to a new answer to the ancient question. The answer is theism. God is a power, immanent in the universe. He is involved in the hazard of his creation. He is striving mightily to produce a perfect display in the world of

sense-perception, of his own true nature. "The whole creation travaileth," because only so can it achieve that purpose.

At present, from our point of view, the finest qualities of the motive power which drives the universe are displayed most adequately in humanity "at its best." The problem concerning the nature of God is in a very real sense coincident with the problem concerning the nature of man. Modern man looks upon the ancient estimates of God, such for example as are disclosed in the creation stories of the book of Genesis, as naïve and inadequate. The patriarchs of old actually created God in the image of man, even though they announced that man was created in the image of God. The modern student of ancient literature describes such concepts of Jehovah as anthropomorphic, and with that label he succeeds in registering his new-found contempt for them. The term usually conveys a sense of scornful judgment, even of righteous indignation. But that increment of scorn is not really native in the term. The fact is that

modern estimates of God are just as anthropomorphic as ancient ones. It is quite impossible for us to get outside ourselves. That which we see is filtered through our eyes; that which we think is filtered through our brains. Because we recognize personality as inherent in the human species, we attribute personality to the motive powers which have produced mankind.

Even in our most self-congratulatory moments it must be perfectly obvious that the achievements of creative energy known to us are still but an inadequate expression of its complete nature. Man cannot imagine, even in his wildest dreams, what the future holds in store for creation. A crystal in a pre-Cambrian granite, formed before life appeared upon the face of the earth, could have had no comprehension of what an organism would be. A one-celled organism in the slime of the Archeozoic Era could have had no comprehension of what a self-conscious man would be. If we were limited to the estimate of creative energy which we could have formed a hundred million years

ago by observing the earth and its inhabitants as they were at that time, we would probably have turned away in disgust at the thought of a God who could produce no better creature than a dinosaur or an ammonite. Obviously it is quite impossible for us now to forecast what expression of creative energy will be a reality upon this earth, or elsewhere in the universe, a hundred million or even a hundred thousand years hence. Not all the resources of the universe are to-day in use, even as many now used were not in use a geologic period ago. In other words, the theistic God is not only immanent; he is also transcendent.

Science makes another contribution to our knowledge of God. At last we are beginning to understand that he is spirit. The etymology of that term is interesting and suggestive. It comes from the same classical root which gives rise also to the words, inspiration and respiration. Breath, to the ancients, was the most attenuated form of matter concerning which there was any general knowledge. Breath and spirit

were analogous concepts. And to many modern folk, spirit still means an attenuated form of matter, a ghost. To the scientist, spirit is no form of matter whatsoever; it is the antithesis of matter. Matter is that something, no two parts of which can occupy he same place at the same time. A satisfactory definition of matter is necessarily phrased in terms of time and space. There is no satisfactory definition of spirit, known to me; it transcends definition. But surely any definition of spirit must indicate that spirit has no limitations of space or time.

We have many heritages in word and thought from our ancestors who frankly described God as a material being. Our ministers still request us to "lift our faces toward the Great White Throne"; they tell us still that "He holds us in the hollow of His hand." Phrases, originally designed to express the thought of God as a majestic, man-like being, are still in common use. But our difficulties are not all in the field of vocabularies; we feel keenly the limitations

of human minds when we try to contemplate the divine. It is extremely difficult to keep God real when we make our concepts of him wholly spiritual. But there are those to whom God as spirit is very real indeed; and to most of us there have come moments, brief and infrequent though they may have been, when the Eternal Spirit was very real to us. I believe we have good reason to expect that with further development of the human mind and soul there will be improvement in our vocabulary and much better realization of what spirit is.

In the meantime, we have the encouragement that God is no longer hiding behind the gaps in our knowledge. We need not fear to push back the horizon which separates the known from the unknown, the natural from the supernatural. The more we know about the world in which we live, the better is our understanding of him, the truer is our comprehension of his character.

God is partially revealed by inanimate nature, with its law-abiding planets and its orderly

chemical reactions. The crystal with its remarkable internal architecture and its beautiful external forms suggests something of the characteristics of the motive power which has brought the minerals into existence. But we find that power on a distinctly higher plane when we consider the lilies of the field or behold the fowls of the air. Thus we learn something of the attributes of the energy that can produce an organism as well as a crystal, that can induce living cells to emerge from non-living matter. Then when we investigate humanity and inquire into the nature of man we greatly enlarge our estimate of the forces that can produce personality as well as organism, that can induce the reasoning mind to emerge from mere consciousness. The scientist studying nature in strict accordance with the rigid methods which he has developed, cannot fail to have a profound respect for the motive powers of the universe. The farther he advances in his discovery of facts and his understanding of human experiences, the better able is he to guide in the

ordering of human conduct toward the goal of a richer and fuller life for man. That is, by discovering the methods of nature we may truly associate ourselves with God in the task of creative evolution.

There is, however, another way of discovering God which, although at present outside the field of natural science, is in all probability a valid approach to him. The mystical experience of the human spirit brought face to face with the reality that transcends knowledge is a most enticing field for investigation, and psychologists are already making progress there. Some of the experiences of the great prophets may be tested in our own experience. In that way we can appraise the qualifications which they possess to serve as experts in the field of spiritual realities. The great religious teachers of the past are not to be judged by magical incidents pertaining to their birth nor by the healing influence of their bones or garments preserved since their death. They are trustworthy only because we have been able to test their

teachings in our own experience. When we find one whose words ring true, so far as we can test them, we are justified in having faith in the trustworthiness of his ideas concerning realities in those realms into which we cannot ourselves penetrate.

Knowledge concerning God, therefore, becomes a matter of human experience which includes both contact with the physical world of sense-perception in which he is the motive power, and also direct, though mysterious, contact with him, when spirit meets with Spirit. The human soul reaching out into the darkness becomes aware of spiritual realities and through personal contact with the Eternal discovers something of the heights and depths which cannot be measured. The experiences of other men enlarge and enrich our own experiences and thus we become the heirs of all the ages. The response of the universe to the lives of great and good men is an expression of the creative energy which has likewise called us into being, and that response when fully understood is

quite sufficient to satisfy our deepest yearnings. In a scientific age, the search for God bids fair to give mankind the wisdom which is more than knowledge.

CHAPTER IV

MEN AND MACHINES

As a man thinketh in his heart, so is he.

HUXLEY once remarked that "the world is absolutely governed by ideas." In this scientific age there is a tendency to believe that on the contrary the world is governed by the law of gravity, the law of self-preservation, the laws of assimilation, of electrochemical energy. Was Huxley right or wrong? Are ideas the governing factors, or are they themselves determined by forces such as these over which man has no control?

Impressed by the inflexibility of natural law in the orderly universe made known by natural science, it is extremely easy for one to assume that the world is operating quite mechanically, and philosophies of mechanistic materialism

seem convincing. The stars are ordered in their courses by forces over which they themselves have no control. Apparently the chemical elements have no choice in the matter, but must always unite in the same way when placed in the same environment, in accordance with external compulsion. The history of plants and animals reveals a similar external determinism. Consider, for example, the habits of the Alaskan salmon. Born in the fresh waters of the rivers and lakes of Alaska, it descends the stream shortly after birth and spends a little more than three years of its life in the ocean. In the fourth year of its existence it returns to the water of the land, there to spawn and die: complicated and ofttimes inconvenient arrangement for the poor fish, something which appears to be determined for it by internal and external conditions over which the individual has no control. Instinct plays so large a part in the lives of most animals that individual conduct on all occasions seems accurately predictable in advance for them. Obviously future conduct may,

however, be predicted only within reasonable limits. When a cat, purring by the fireplace, is suddenly disturbed, you cannot tell with precision which way it will jump; but you can predict that if a dog enters the room, certain definite reactions will take place. Instinct is something over which the individual seems to have no control. In so far as conduct is determined by instinct, the actions of animals are predictable in advance, just as the movement of a stone when dropped from a height is predictable.

Human conduct is so profoundly influenced by heredity and environment that sometimes we wonder if these external conditions do not absolutely determine our actions. Do we ever "make up our own minds" or are our minds "made up" for us by forces over which we individually have no control? Are not men mere machines, cogs in the world mechanism, doomed to grind on automatically, caught in a treadmill? Was Huxley wrong, after all?

Obviously there are many real differences between organisms and machines. Machines

cannot repair their own damaged parts; they cannot reproduce themselves; they cannot grow. Organisms can, within limits, do all of those things. A wound is healed by healthy tissue; damaged parts of plants or animals are promptly repaired, provided the organism is in a healthy condition and the damage is not too great, though, among the more complex animals, such as vertebrates, an amputated arm or leg does not grow again.

An organism, small or large, simple or complex, is obviously different from a machine; and of course, man is an organism, one of the most complicated of the living structures which populate the earth. But that is not the real issue. Every action of an organism is in accordance with laws which not only set the limits within which the action may take place but also determine the nature of the organic response. The real question then becomes: Are not organisms mere automatons, differing from other machines only in degree and not in kind? Doubtless organisms are more complex; doubtless they are

more efficient along certain lines; certainly they are able to do things which ordinary machines cannot possibly do; but are they possessed of any freedom, any volition of their own?

The negative answer to that question is implied by the philosophical trends that have led many people to a distinctly fatalistic attitude toward life. In the World War a man would say, " If my name is on a bullet, I die to-day. If not, I can go over the top, into the hell between the lines, in safety." It is very common for men in warfare, or in any situation of danger or stress, to seek refuge in a fatalistic philosophy just for peace of mind. But it is also a philosophy that comes to many men in quieter moods when they have opportunity for profound contemplation. The question is therefore a truly vital one. It strikes at the very heart of any philosophy of existence.

In approaching such a problem it is natural for a geologist to adopt the historical point of view. The geologist is engaged in discovering the history of the earth; it is his business to

decipher the past in order to interpret the present and predict the future. The methods of geology may be applied even to so unsubstantial realities as those involved in any appraisal of men, machines, and mystics.

The crystals of such a mineral as quartz, for example, which were formed near the dawn of recorded geologic history when the oldest known rocks of the earth's crust were being constructed, are identical with the crystals of quartz that were formed quite recently when the granites of the Andes were congealing. The molecules of silica which compose those crystals of quartz arranged themselves quite automatically in a purely mechanical way whenever and wherever they were associated together. It matters not whether they formed a quartz crystal a billion years ago or only yesterday; the quartz crystal is the same. The laws of crystal structure provided no opportunity for variations in crystal form as the geologic periods unfolded. In consequence, every type of crystal known in nature was formed in the earlier as well as in

the later geologic periods. Moreover, considerable diversity of environment has no effect upon the internal arrangement of the crystal. Quartz formed from cold water, in such a cave as Crystal Cave in Arkansas, may be identical in structure with that crystallized from molten lava deep in the interior of the earth. Under notably different conditions of temperature and pressure, the same molecules arrange themselves in identical structures.

But the cells of plants and animals have changed from age to age. The oldest rocks contain no fossils whatsoever. We have no knowledge, therefore, of the nature of life which existed when those oldest rocks were being formed. The oldest fossiliferous rocks were formed before the end of the first of the five great eras into which earth history is customarily divided. The scanty record which they contain indicates an assemblage of very simple, lowly creatures. To be sure, there is no reason for assuming that all forms of life that were in existence at any one time or place

were preserved in the record. But there is good reason for believing that the extensive records of the next four eras give fairly accurate pictures of the successive assemblages of living creatures which have populated the earth. From them we may gain real insight into many of our own problems.

In the consideration of geologic life development, emphasis is usually placed upon the progressive attainment of more and more complex body forms and structures during the recorded history of the earth. From lowly, simple, one-celled or few-celled organisms there gradually developed the higher types of creatures with their complicated and interrelated organs and tissues. Thus the modern assemblage of varied creatures, ingeniously adapted to diversified environments, was brought into existence. Organic structures wholly unknown in the earlier geologic periods were present in the later; modes of action not possible during earlier times were made possible as evolution went on. New abilities emerged during the

process of life development. Combinations of cells could do what individual cells could not do.

It is also significant that the individual cells have changed as time advanced. Consider the large and varied group of one-celled animals called protozoa, creatures of microscopic or very small size whose bodies consist of a single cell of jelly-like protoplasm. It happens that one branch of the protozoans, known as the foraminifera, is especially well known to geologists because of the use to which fossil foraminifera have been put in connection with the search for petroleum in the Gulf Coastal Region of Texas and Mexico. Although these creatures never rose above the plane of one-celled existence, they display conspicuous changes in form and habit from period to period. The tiny houses, or "tests," which surrounded their bodies are preserved in many of the rocky strata formed from the mud and sand washed into the sea where they lived. These fossil foraminifera show unmistakable evolution when arranged in

the order of the successive strata in which they are found. Having learned something of their evolution and their occurrence at different stages in earth history, the geologist may now use them as an index to the rocks in which they occur. A handful of chipped rock fragments, brought up from a drilling well, the bottom of which is at the moment perhaps 2,500 feet below the surface of the earth, is examined under the microscope, and from the study of the foraminiferal fossils, the geologist discovers in which particular layer of rock the drill is working. Even though these protozoan cells have not progressed by developing into complicated organisms, they have changed conspicuously from age to age.

It is, of course, true that there has also been stagnation in animal and plant development. Many forms of life have remained fixed and changeless, age upon age. The waves beating to-day upon the coast of Wales are exhuming from the Cambrian rocks of that sea coast the fossil shells of bivalves known as brachiopods.

Those fossil shells are caught in the undertow on the beach and are mingled with the shells of living brachiopods, from which they are scarcely distinguishable in form and appearance. These Cambrian brachiopods lived during the first geologic period from which we have a fairly adequate record of life. Throughout all subsequent time, while other creatures were changing their body structures, this group of brachiopods remained on a dead level. If success is measured only in terms of quantity of existence, then by their longevity these brachiopods have succeeded far beyond any measure which is possible for most other forms of life. But such stagnation is exceptional; most living cells change from age to age.

Such changes revealed by the geologic record, imply not only the progressive development of more and more complex body forms, but also the modification of the single cells with which each individual begins his history. Evolution is not simply the piling up of cell upon cell, the organization of many units into a body. Geo-

logic life development involves also the modification of the single cells with which each individual begins his life history. Somehow, out of the continuity of the process real differences in cell structure have emerged. Obviously this has been accomplished in accordance with law; but the laws which govern vital activities are thus decidedly in contrast with the laws which govern the transformations of inanimate matter. The crystal and the cell are both structures formed in obedience to law, but the laws which determine crystal structure are not in the same category as those which determine cell development.

In attempting to discover these laws, the geologist is impressed with the fact that environment has exerted a profoundly important directing impulse upon the development of life. The evolution of the horse family is a classic illustration, easily understood and rather completely known. The ancestral horses were small five-toed, herbivorous vertebrates, with a back arched like that of a dog or cat. Evolution to the

modern one-toed horse was at least in part a response to the changing environment of western North America from a region of humid forests, with soft boggy turf, to treeless, wind-swept, hard-turfed prairies. This change is celebrated in one of the best known verses from the paleontologist's anthology, which depicts the exploits of the "Dawn Horse," Eohippus:

"Little Eohippus was no bigger than a fox,
And on four toes he scampered over Tertiary rocks;
'But,' said little Eohippus, 'I am going to be a horse,
And on my middle finger nails, I'll run my earthly course.'"

The facts indicate that in the evolution of the horse successive generations stood more and more on tiptoe. They specialized in ability to make a quick start and to keep long-sustained, swift flight in order to escape the sabre-toothed cats and other carnivora. As the heel was thus lifted higher and higher from the ground, the lateral toes were of less and less use. In time

they dwindled in size until to-day only tiny splints of the second and fourth toes remain and the third toe bears all the weight. The modern horse walks upon the tip of its middle "finger nail."

But the poet was obviously in error. No matter how interesting the quatrain may be, Little Eohippus had no vision of his splendid equine descendant, the modern horse. Evolution toward that goal, which seems to have gone forward directly and surely, was in fact a response to the changing environment, over which none of the horses had the slightest control. Sufficient unto the day was the evil thereof for Eohippus and his descendants. To escape from enemies, to find food for sustenance and to care for their young, doubtless kept them well occupied each day with problems. They could not have known that the forests were doomed to give place to prairies, as the Rocky Mountains were gradually uplifted and cut off the moisture-laden winds from the Pacific Ocean. Presumably there were many members of the horse

family who decided to remain in the ancestral abode of the forest, with its boggy ground strewn with leaf mold and its succulent vegetation, while others ventured farther and farther out upon the prairies. Possibly those who clung conservatively to the familiar forest may have been a little surprised and shocked as those forests gradually dwindled to disappearance and the prairies alone became available for the further course of equine history.

But environment was not the only factor in that history. The three-toed horse could not arise except as the offspring of a four-toed or a five-toed horse. The single hoof of the genus equus, the modern horse, could evolve only as the lateral toes of the three-toed horse decreased in size. Heredity has in the past been just as essential as environment. It is useless to waste time considering which is more important, heredity or environment; neither could have accomplished anything alone.

As for horses, so for men. Heredity and environment set the limits within which our lives

are spent. Psychologists and sociologists are increasingly successful in discovering how the two factors correlate to determine the capacity of the individual. Doubtless, aptitudes are determined for each individual by heredity and environment. But when we press the idea further, we are likely to get into danger. Any truth pushed to its ultimate extreme becomes dangerous and generally foolish. Thus, in our modern penology we have discovered that certain individuals are criminal by nature. They do things of an anti-social character wholly without volition on their own part. We send them to the psychopathic hospital and then we isolate them where they belong; not in a prison to be punished, but in institutions where if they cannot be cured they may at least be protected and removed from contact with the rest of the world.

Excusing the lunatic for his misdeeds sometimes has led the normal individual to the idea that he also should be excused from all responsibility for what he does. "I couldn't help it;

it was my heredity and environment which determined this course of action for me; so don't blame me." It is generally a cowardly plea. There are some who should not be blamed for what they do; for them, poor souls, heredity and environment have set limits which closely cramp and narrowly confine, but for most of us there is plenty of unoccupied territory. Heredity and environment are far kinder to the average human being than most of us are willing to admit. Rare indeed is the man whose attainments equal his possibilities, who actually makes the most of his life.

Within the limits thus determined for him, each individual seems to choose where and how he shall live. Or does heredity select from among the offerings made by environment? An enticing theory, is it not? Environment puts the circle round about our lives; heredity determines the choice of the particular quadrant of the circle in which we shall live.

That there has been choice can not be denied by the believer in evolution. The record of the

rocks indicates that the forward steps in life development have at each stage been taken by only a very few individuals among the many for whom the opportunity was available. Back in the Devonian period, for example, long before the Appalachian Mountains were crumpled upward along the eastern border of this continent, there were living a host of so-called "lung fishes." At that time in the region now occupied by the northeastern States, there was a semitropical environment with profound variation from an excessively dry to an excessively wet season each year. The compulsion of seasonal dryness seems to have exerted an awakening influence upon those lung-fishes, and from them, at that time and in that place, evolved the amphibians, the first air-breathing vertebrates. But perhaps no more than one or two in each generation of those Devonian lung-fishes took the opportunity to develop the organs and structures which eventually permitted those first venturesome amphibians to walk out on the land. Many were called, but few were

chosen. The gains in the history of life have been made by risk-taking minorities in spite of the overburden of conservative majorities. In the human heritage there is no taint; nature's derelicts have ruthlessly been weeded out; of our heredity we may well be proud.

But in the last analysis it is environment which has determined heredity. If all living species of animals and plants have arisen through modification from one single-celled, primordial plant-animal, as we evolutionists believe, then the differences in heredity are either purely imaginary or are themselves a response to varying conditions of environment. The only other alternative which might as a wild but possible working hypothesis be considered is the thought that in the beginning of life there were many primordial one-celled organisms, each of which was then foreordained and predestined to be the ancestor of a line of offspring reaching to each existing or extinct species. That to the evolutionist is unthinkable because of the obvious close relations of living creatures. The "tree of

life " is rather a great shrub with a single central root or stem from which the branches divide and subdivide again. The creatures of to-day are the tips of these many branches. We may trace back each tip into its twig, the twigs into the branches, the branches into the limbs and the limbs into the central stalk. Evolution began when the first living cell became two separate individuals, the second generation of living creatures upon the face of the earth. The differences in the heredity of those two individuals must have been determined by the surroundings of their parent cell at the moment of division. Environment can not at the same time offer opportunities for choice and determine which opportunity shall be chosen. We escape from the vicious circle of such reasoning only by assuming that each organism does in some way, of its own free will and accord, choose from certain limited potentialities of existence those which shall for it be realized as actualities. And therein is the real difference between organisms and machines.

The geologic record shows unmistakably that

the number of choices available for living creatures has steadily increased throughout the ages. For example, the limits within which vertebrate life can exist have notably expanded. At first, back in the early part of the Paleozoic era, the vertebrates could live only in an aquatic environment, for they were all fishes and must breathe by means of gills. Then, a little later, some of the vertebrates acquired a mode of respiration which made them free to live also on the dry land. Later still the vertebrates conquered the air. Birds are obviously at home in a greater variety of environments than are fishes.

So the limits circumscribed about each individual have expanded as a result of evolutionary progress. Thus, living creatures, the offspring of the earth, have been gradually subduing the earth. Vital energy has discovered how to manifest itself in new and previously untried environments, has developed the ability to express itself in a greater and greater variety of ways.

The real measure of the progress of life from

stage to stage is the diversity of opportunities for self-expression which are available at each stage. On such a basis man may be compared with other organisms. The so-called lower animals have ordinarily specialized in adaptation to some particular environment: horses to prairies, alligators to swamps, horned toads to deserts. But man has specialized in adaptability to all environments. Man alone, among highly specialized animals, can live where he pleases: in the tropics or at the poles, beneath the sea or high in the air, deep down in the ground or on the mountain summit. Man is a specialist in adaptability, not in adaptation.

Man has succeeded in developing adaptability because he began early, when the body was still quite generalized, at the time when the ancestors of man were as unlike us as Eohippus was unlike the modern species of horse. Man has retained even to the present day many features of the generalized body of primitive mammals. He has thirty-two teeth; progress in the development of vertebrate jaws is marked in other

forms of life by reduction in the number of teeth, but man has retained almost, although not quite, the maximum number which mammals can have. Man has five fingers and five toes: the horse has far exceeded him in the development of appendages for locomotion, by reducing the digits to one. The horse is a specialist in locomotion and can easily outdistance man when man plays fair and races on foot. Instead of specializing in some one activity, the ancestors of man retained the more generalized body structure and made possible the adaptability which modern man displays.

At the same time, man has succeeded better than any other creature in remaking environments to suit his whims. The beavers build a dam to create the environment of the swamp in which they want to live. The tropical ants build mounds to serve as islands on flooded river flats. But man does more to the face of the earth than all the other animals combined. He drains marshes and irrigates deserts. He strips the trees from forested hillsides in the

eastern states to develop farm lands and pasture fields; whereas on the treeless prairies of Kansas and Nebraska he plants trees for a windbreak at the far side of the wheat field, or a shelter and a shade for his farmstead. As he thus succeeds in molding his physical surroundings closer to his heart's desire and at the same time in adapting himself to a wider range of living conditions, he frees himself from the control of environment; or, more accurately, he enlarges the limits within which environment confines him. He pushes back the horizon and discovers for himself new areas of self-expression. If this be true for mankind collectively, then necessarily it must be true for men individually.

With increasing opportunity for choice there comes increasing responsibility upon the chooser. Making all due allowances for heredity and environment, still is it true that each normal human being must stand on his own feet, must accept the consequences of his own decisions. When a man makes up his mind, he changes

the course of history. Perhaps it is only so trivial a thing as the selection of mayonnaise rather than Russian dressing for his salad, but history is merely a summation of trivial events. Therefore, ideas govern the world.

Just what is involved when the organic prerogative of making a choice between two lines of conduct is exercised can not now be told. That is to say, the laws by which the organic world is being governed are not yet understood. That there are such laws is an inescapable inference from all that we know about ourselves and the world in which we live. The mystery about them does not invalidate the fact of their existence.

In the attempt to penetrate this mystery, the psychologist does well to study the reactions of the so-called "lower animals" to stimuli of one sort and another, but it should always be remembered that new modes of action in obedience to new laws have emerged from the process of evolution. Just as the living cell is distinguished from the non-living crystal, so is the

psychical distinguished from the merely physiological, the social from the solitary. It should not be assumed that human actions must in every particular follow the same principles as those of other organisms. Wherein man differs from other creatures is to be discovered by experiment, observation, and experience, and in no other way; it is purely a question of observable fact.

Out of a world governed by the law of gravity and the laws of atomic structure is emerging a world in which mentality is a powerful directing force, a world in which purpose does make a difference, a world wherein "intelligence is practical and a source of power." This history of the past leads directly to the conclusion that it is perfectly reasonable to hope and strive for the realization of ideals that have never yet been realized. When new conditions arise, new laws become operative. The very fact that men attempt to determine their own conduct, to transform the world in which they live, to instill more satisfactory ideals in the minds of

themselves and of their fellows, is fair ground for the expectation that these very things will be accomplished. Apparently, in the past, the things which organisms *tried* to do were the things which organisms sooner or later *were able* to do. A world evolving as our world seems to evolve is absolutely governed by ideas.

If men actually do make up their own minds, as they certainly seem to do, then thoughts are more significant than the mechanism by which they are expressed. Mysterious though it be, the imponderables are just as real as the ponderables. Our inability to explain all that we know is disappointing and perplexing but most of us have found it rather necessary to accept the universe. The mystic takes the facts as he finds them. He believes that the spiritual is just as real as the material, the abstract as the concrete, the values as the things valued, the personality as the person. Explain it or not, the fact remains that man is something more than the mechanism perceptible to the five senses.

CHAPTER V

MIRACLES AND PRAYER IN A LAW-ABIDING UNIVERSE

Great peace have they which love thy law,
And nothing shall offend them.

REASONING minds have found response in a rational universe; the day of magic is past. Science has given us a vivid impression of the law and order which characterize the world. The attributes of the universe, so far as known to us, are such as to make obvious and necessary the conclusion that its administration is orderly, that God is a God of Law. Our minds rejoice to find him so; only thus is he worthy of our trust. Only if he operates consistently, can we hope to discover his nature and his purposes. Everything we know about the universe indicates that it is being admin-

istered in a law-abiding manner. Philosophically, as well as scientifically, there has been a tremendous advance from the time when the universe was believed to operate in obedience to caprice or passing whim, when Jehovah repented to-day for what he had done yesterday, when events were conditioned by the odors from burnt offerings that assailed his nostrils, when Jove became angry in a fit of very manlike temper and did things which later he would greatly regret.

God is a God of Law, therefore trustworthy, therefore congenial to the scientific mind. But the new knowledge of God brings a real problem in its train. Most new knowledge introduces dilemma; as we enlarge the field of our understanding, the lifting of the horizon reveals pitfalls, bogs and swamps as well as fair vistas and rolling hills. If God is a God of Law, operating always and everywhere in the same way, how can he also be a God of Love, helping you and me in our time of need? We may grant, as most people do, that the regulations

and arrangements of the universe are such as to make possible the collective prosperity of the particular species of creature to which we belong. We may concede that in the long run things presumably will come out all right, that the human race will somehow muddle through. But the human spirit yearns for something more than that. Our hearts demand a God who can do a retail business even though engaged in wholesale transactions, who can touch us individually, here and there, now and then, at our particular point of need. Is the demand unreasonable? Has modern science relegated to the limbo of untrustworthy jehovahs, the "Personal God" of the Christian? This is an outstanding problem in the minds of thoughtful men and women to-day. It is approached from many angles, most commonly perhaps through the consideration of prayer and miracles. It frequently expresses itself in the closely related question: does the modern expectation of orderly sequence in every department of nature consign miracles as well as magic to the dis-

card? Has prayer any function in a law-abiding universe?

Probably there are few words in the English language more loosely used than the word, miracle. Its definitions are numerous and conflicting. "A miracle is something beyond the power of man to perform." Then, the movement of the stars through space, the rotation of the earth upon its axis, these and similar phenomena are miracles. Or again, a race between a train and an automobile to a grade crossing ends in a tie; the automobile is smashed to fragments, but the driver emerges unscathed from the wreck. As he tells the story, he will very likely say, "It was a miracle that I escaped alive." Neither of these definitions touches the real heart of the miraculous. From the religious point of view an event is a miracle only if it serves to reveal something concerning the nature and purposes of God. Thus, in the New Testament the words, *sign* and *wonder*, are frequently associated in references to the miraculous. A miracle is not merely an extraordinary

event, an unusual or spectacular episode, a *wonder;* it is also an illuminating event, a means of revealing to man something of the character of God, a *sign.*

Concerning every reported miracle, whether recorded in ancient scriptures or related as a current event, three questions ought to be asked in turn. First, did the episode actually occur as recorded or related? The first precaution of the scientist is to make certain that the facts are accurately and adequately in hand. Even cursory examination of the statements made by historians of ancient times indicates that the well-known fallibility of the modern representative of the press is not a new trait of human nature. Men have been reporting things with error from the very dawn of written history. If this is true among men trained in scientific habits of mind, as it surely is, it is even more true of the pre-scientific age. Some of the miracles of the Bible, for example, are merely legends, bits of folk-lore told round the campfire or in the tent as a patriarch gathered

his family about him for instruction in history and morals. Such "miracles" quite naturally improved much in the telling and ere they had been handed down through many generations they became truly marvelous stories. Exaggeration of fact is even yet justified by some as the best way of attracting attention and holding interest. More than one public speaker has condoned his own habits by asserting that unless he exaggerated his statements nobody would pay any attention to what he said! Generally, an alert and intelligent listener detects exaggeration as it is made; respect for the printed word should not hinder similar detection of the exaggerations which have been made in the past.

Another reason why the records or reports of supposedly miraculous events are not historically accurate is traceable to the fact that the human mind naturally attempts to explain every occurrence which it notes. It is characteristic for a man who has been impressed by an incident to pass quickly from the statement of what

occurred to an explanation of what occurred. First in the minds of his hearers and then in his own mind the explanation becomes so intimately intermingled with the description of the incident that they can scarcely be dissociated one from the other. Thereafter, the explanation of the fact may be set forth as though it were the fact itself.

Biblical literature is liberally sprinkled with this sort of record. During the conquest of Canaan, a particular day of crisis was so filled with soul-stirring incidents, the clash of arms, the final victory for the soldiers under the banner of Joshua, that it seemed to have been an unusually long day. And for those who experienced the incidents of that day, it was uniquely long; never for them was there a day like that, before or since. Promptly their minds jumped from the experience to the explanation. How did that particular day happen to be so long? To people who thought the earth was flat, who believed that the sun actually climbed in the eastern heavens to the apex of the vaulted fir-

mament and then descended to the west, the obvious explanation was that the sun had stood still for a time in heaven. The explanation is recorded as though it were the fact.

The critical question concerning the accuracy of the record or the report must often be answered in the negative. Occasionally we can strip off the exaggeration and the explanation and discover the actual nature of the incident or the experience, but often it is impossible to do so and no definite answer to the question is forthcoming. In that case it is worth while to proceed to the next question only if we assume what the actual episode probably was. If we do that, we must always remember that the value of the miraculous event is no more certain than the assumptions which have been made concerning its nature.

The second question is the philosophical one. Having sifted the records critically, a residue of fact has been obtained. We believe that certain things happened. We inquire, can the event as thus related be explained so that we

may understand how it occurred? Is it a *wonder?* It is to be expected that with advances in knowledge, events formerly quite beyond the pale of human understanding should become amenable to rational explanation. Incidents which formerly were beyond comprehension can now be explained. Many of the miracles of healing recorded in the Bible are now rather well understood because of modern knowledge of the laws of psychotherapy. In one sense of the word, the advance of science reduces the wonder with which man is impressed by the phenomena of nature. In another sense, the element of wonder is actually increased by scientific understanding. Is radio-telephony less wonderful to the electrical engineer than to the untutored savage of a tropical jungle?

Be that as it may, the third question is obviously the most important. It is the religious question. Of what is the event significant? What is its moral value? Is it a *sign?* Under the outworn deistic theory of the administration of the universe, the more inexplicable the

event, the more significant it became. Overwhelmed by primitive wonder, brought face to face with that which transcended all understanding, man had witnessed the intervention of God in the affairs of nature. The abnormal event transpiring without reference to any controlling laws, with no necessary relations between causes and effects, was a sign that God had interfered to make an adjustment in the machinery, that he was communicating directly with men. Moral values were promptly assumed. Sodom and Gomorrah were overwhelmed by the ashes of a volcanic eruption because not even ten righteous men could be found among the inhabitants of those cities. But to the theist, the significance of an event increases as it is rationalized. The more completely he understands how it occurred, the deeper is his insight into the character and purpose of God. In other words, it is quite impossible " to explain a miracle away." Probing into the methods of nature reveals the real meaning of the natural world. As primitive

wonder is decreased by rational understanding, the significance of the event is deepened, its value as a sign is increased.

To the man of science, all the world is now marvelous; every event is both wonderful and full of significance, a means of becoming acquainted with the administration of the universe. Only as we succeed in following through the rational chain connecting cause with effect, can we hope to discover the meaning of life. "Greater works" are now being accomplished than ever before in the history of man. Consider, for example, the establishment of a medical service which will within a few years rid India of leprosy. Something in the universe has worked through the minds of technically trained men so that they have been led to a discovery of the cause of that dread disease and thereby have learned how it may be prevented. Something in the universe, moving upon the hearts as well as the minds of the citizens of a great commonwealth, has impelled the British Parliament to appropriate large sums of money,

not for the immediate benefit of the inhabitants of England, but for the people of a distant land. Such events are truly significant of the character of the world in which we live. A greater work is being accomplished than the healing of ten lepers among the hundreds on the shores of Galilee.

But, as might be expected, this expanded concept of the miraculous brings its attendant difficulty. If all the world is now miraculous, how may we recognize among the countless events of our lives those which reveal God in his true relations to mankind? Obviously, not every event which takes place is in perfect harmony with the finest possibilities inherent in the energy manifesting itself in the world of sense perception. Things which are unfortunate for the universe happen as well as those which are fortunate. By what standard may we judge these events? How may we discriminate between the temporary and individual tendencies on the one hand and the eternal and universal tendencies on the other? That of

course is the problem of religion; it is beyond the pale of science. It is exactly the field in which religion is supreme, the field of values. Science describes the event, relates how it occurred, suggests its possible significance; but religion must determine its value.

For the Christian, the answer is clear, because the Christian has assumed that Jesus of Nazareth displayed the true character of the Administration of the Universe. The answer is analogous for adherents to any of the great religious sects, for every religion is built around a personality and in each a similar assumption is made. Allegiance is pledged to a particular personality because of the assumption that the individual life correctly portrays the qualities of the Supreme Personality. There is no way to prove the validity of this fundamental assumption except the method of science: try it and see. Having made this assumption, the Christian merely asks a fourth question to complete the series pertaining to the miraculous. Does the event, when rightly

understood, promote or strengthen in men the type of character which may be seen in Christ? For this reason, Christ is the touchstone of Christianity; because of the importance of this question, we try to bring others to see him as he really was; as long as men ask this question, he will continue to be a living power in the world.

This view of miracles as perfectly natural phenomena rather than as supernatural manifestations, is welcomed by all who believe in the essential and underlying unity of the universe, but it of course presents from a new angle the problem of freedom. The inquiry concerning the freedom of the human will, the ability of the individual actually to make up his own mind, is matched by the problem of the freedom of God to devise and attain certain goals. Is the Administrative Personality supreme, if it is limited to expression only within the laws of nature?

The statement that God is omnipotent has proved to be a stumbling block for many

thoughtful persons. Obviously, omnipotence should not imply that God can do anything and everything; no power can make a three-year-old horse in three minutes. Any one can think of countless things which not even a Supreme Power could do; but this is very evidently pushing a truth to a ridiculous extreme. Rather is it true that the Administrative Personality has all the power that there is, and in that sense only is God omnipotent. Omnipotence implies the ability to use all available power, rather than the capacity of accomplishing everything that any mind can possibly imagine would be desirable or interesting to accomplish.

But modern science gives us abundant reason for believing that all the forces operating in the universe are law-abiding. If therefore God the omnipotent is confined within the bounds of natural law, how can he be a "Heavenly Father" who answers the pleas of troubled humanity? The problem of the miraculous is thus intimately linked with the problem of prayer.

As we attack the twofold problem from this angle, we must first of all get a clearer understanding of what is meant by natural law. A. S. Eddington, an eminent British physicist, has recently presented a very helpful analysis * of the scientist's understanding of the laws of nature, which he groups in three categories.

There are, first, the " identical laws " such as the law of gravitation, the law of conservation of mass and energy, and the laws of electric and magnetic force. These are commonly cited as typical instances of natural law and are the first to come to mind in any consideration of the immutability of law.

Second, there are the " statistical laws " which are obeyed by groups independently of the characteristics of the individuals composing the group. Among these are the laws of gases and of thermodynamics. The assemblage of molecules in a body of gas obeys the statistical laws regardless of the composition of the gas. An

* *Science, Religion and Reality,* ed. Joseph Needham, New York, 1925, pp. 214-216.

expanding gas absorbs heat at a rate determined by its expansion, not by its constitution. Certain gas wells in Texas may be observed with the valves and pipes constantly incrusted with frost although exposed to the hot sun of a Texan summer, because of the release of pressure as the gas escapes from the ground into the enlarged pipes at the surface. The laws are the same, whether it is the natural gas from the ground, the sulphur dioxide of an electric refrigerating machine, or the pure oxygen of a laboratory experiment.

In the third category of natural laws are placed the "transcendental laws" of atomic structure and of the quantum process. These laws determine the association and movement of electrons and protons, the form and construction of the atom, the "flow" of energy. No one has yet succeeded in forming an intelligible conception of the quantum process, yet enough is known about it to indicate that it is a most amazing development of physical theory. Two notions concerning the nature of light have

long been under consideration. One, the corpuscular theory, implies that light consists of separate, extremely small, but material bodies hurled, like a stream of drops from a high-pressure hose or a succession of bullets from a swift-firing machine-gun, at such tremendously high velocity as to enable them to penetrate any objects in their paths. The alternative theory of the nature of light is the vibration theory which postulates the existence of a mysterious medium, the ether, the vibrations of which constitute light. The quantum theory is in a certain sense a compromise between these two conflicting ideas. It implies that the energy vibrating through space consists of separate discrete particles, not of matter, but of energy; that energy "flows" not as a steady stream, but as a succession of swiftly consecutive impacts. The individual units of energy are the "quanta" which give the name to the process and theory.

The three kinds of natural law have interesting relationships to each other. In the first

category are laws pertaining to processes that science can now both describe and explain. The laws in the second category pertain to processes which have been described but cannot yet be explained. Whereas in the third category are laws pertaining to processes which have not as yet been either satisfactorily described or adequately explained.

Never in the experience of man has an identical law of nature been violated within the limits in which it has been discovered to operate. The law of gravity is an excellent illustration. It is frequently asserted to be a universal and inviolable law. Such it surely is, but only within certain limits. In our everyday experience there are frequent demonstrations of its limitations. The excess ink upon the letter paper is absorbed into the blotter placed above the writing pad; the liquid has risen in obedience to other identical laws which operate with utter disregard for the law of gravity. Oil rises in the wick of the kerosene lamp and keeps the flame burning steadily, because its move-

ment is in a region beyond the limits of gravitation. Molecules of liquid in close contact with molecules of solid substances, such as the fibers of the blotting paper or the cotton wick, obey the laws of adhesion and cohesion rather than the law of gravity. It is not that the law of gravity has been violated; it is merely that the territory in which that law is supreme has been transcended. Under certain conditions the capillary forces are more powerful than the gravitational; each identical law is inviolable only within definite and generally recognizable limits. Much more must be learned about the limitations of the several laws of nature before we may assert that God and man have by them been robbed of freedom.

Even within their appropriate limits, the identical laws do not annihilate freedom; in one sense, they do not even restrict freedom. Give an artist a piece of blank paper and a crayon; tell him he is free to draw anything he wants, that no one will ever censor his artistic creation. Still is he bound; he cannot, for example, draw

a circle the circumference of which is exactly six times its radius. To do that would be to violate the laws of nature, which manifesting themselves in the fundamental principles of Euclidean geometry decree that the circumference of every circle shall have the relationship $2\pi r$. But did an artist ever complain that his style was cramped, his freedom limited, that he could not express himself satisfactorily, because he could draw no other circle than this? That restriction, whatever it may mean, does not prevent him from giving expression by his art to his creative personality. Surely, if this be true for an individual human personality, the supreme administrative personality can similarly display its creativeness within law.

More important than this inference, however, is the fact that the identical laws are really not laws of governance; they are merely descriptions of what occurs. The law of gravity, for example, states that gravitation varies inversely as the square of the distance between two bodies and directly as their mass. This is merely a

description of the behavior of the force of gravitation; it does not tell *why* gravity varies in this particular and peculiar manner. The laws which really govern the universe are the statistical and transcendental laws. Although these laws still baffle us, we have every reason for believing that they are rational and inviolable; that they are truly laws. These administrative regulations determine how " spirit with Spirit may meet," how a man may " make up his own mind "; they explain why there should be in living organisms a ceaseless urge to change, a " divine dissatisfaction " with the existing conditions. Because of them and through them, " ideas govern the world."

This presents the challenge of the moment: discover the nature of the transcendental laws, find out the regulations in accordance with which the universe is really governed. It is the most difficult task to which mankind is summoned, a task requiring breadth of vision as well as keenness of intellect, wisdom as well as knowledge. Fortunately, it is not necessary for

us to complete the ultimate analysis of the structure of the atom before we can make use of transcendental laws. Gravitation was utilized by primitive man long before Sir Isaac Newton was born. Experience is the companion of observation among the scientist's tools. Interpretation of experiences is often more difficult and more valuable than the analysis of objective observations.

This challenge transfers the problem concerning prayer from the administrative to the operative end of the chain. Or from another point of view, it promotes mankind from the position of office boy to that of executive partner in the organization of the universe. Many persons are unwilling to pray because they are afraid they will ask God to do something which he cannot do; but the real difficulties are at this end, the human end of the avenue of prayer. Most assuredly we cannot expect that because of prayer, whether or not it be accompanied by the bribe of a burnt offering or a promise, whether or not it be couched in cer-

tain magic phrases, natural laws will be set aside. We cannot expect that the administration of the universe is sufficiently inconsistent to overturn one set of laws by any other. Each established law will continue to operate unchanged throughout the entire area of its individual dominion. But may it not be that prayer is one of the established laws of the universe, and as such has its appropriate position among the transcendental laws? Experience seems to indicate that wherever any human element enters into the problem, prayer is an essential part of the process of giving expression to the Supreme Personality. The reservoirs of spiritual power are full; the laws by which that power may enrich human life are established; the ability to use those laws is potentially present in man. But the flood is dammed at this end of its channel, not at its source. The barriers are erected by human nature, they are not inherent in the nature of the universe.

It is my personal belief that prayer not only reacts psychologically to benefit the one who

prays; it also puts at the disposal of the Transcendental Spirit a tool which, however weak or tiny it may be, is nevertheless indispensable in the project of creating a world which will be an adequate expression of the nature of God. I would suggest that in the healing of disease, medicine without prayer is just as foolish as prayer without medicine. On the other hand, in the present state of my knowledge concerning meteorology and my expectation concerning transcendental laws, I would not spend one moment of my time praying for rain or for the cessation of a storm at sea. I do not now see how the human element can possibly be involved in such affairs. In contrast, I would consider it a justifiable expenditure of energy to pray that the citizens of two unfriendly nations should dare to take a chance that human nature is much the same on both sides of the boundary line and should act on the belief that love is stronger than hate, brotherliness more powerful than battleships.

CHAPTER VI

THE PRESENT TREND OF SCIENCE AND RELIGION

When he, the Spirit of Truth, is come, he will guide you into all truth.

THE thorough-going reconstruction of religious faith resulting from the impact of modern science upon inherited religion has engendered a fear in many hearts that the acceptance of the scientific viewpoint will lead eventually to the complete abandonment of religion. It is not unusual for a contrast to be drawn between science with its confident assertion of facts, and religion with its appeal to the unknown and unknowable. Science is believed by many to rest upon "proof," whereas religion must depend upon "faith." Science may boast of its achievements; religion can only announce its hopes.

Or the comparison may be made in terms less partisan toward science. To some, religion with its infallible revelation from the Supreme Being is preferable to science with its constantly changing theories and its conflicting judgments made by fallible human beings. Religion affirms its knowledge concerning ultimate realities and infinite verities, whereas science merely concludes that it is reasonable to believe certain inferences concerning immediate causes and temporal forces.

Neither of these contrasts is fair, either to science or to religion, and the present trend is carrying thoughtful men to a safer and saner position, far from the old battle-grounds. In the last analysis, science and religion both rest on faith. Science is succeeding notably in its endeavor to make human life more comfortable, because it acts on the basis of certain specific assumptions. This is the essence of faith: not merely the *holding* of a belief, or the *making* of an assumption, but more than that, *acting* on

the basis of the belief or as a result of the assumption.

The fundamental assumptions of science are: first, that human senses report accurately the characteristics of the external world and thus enable us to interpret aright the physical universe in which we dwell; second, that there is uniformity of action in nature so that effects always follow causes in accordance with laws which are universal in their application. Neither of these assumptions can be proved by any reasoning process that the logician has been able to discover. Nevertheless, we have complete confidence in their validity; they have been repeatedly justified by experience. We commonly test the rationality or irrationality of an individual by observing whether or not he acts on the basis of these assumptions. As I glance up from my desk toward the door I receive the impression that chairs and other desks intervene between me and it. The lenses of my eyes have received certain impulses which, transmitted along the optic nerve, are

interpreted by my brain as indicating the presence of certain concrete objects existing in the field of vision. If I rise from my chair and move directly toward the door, I will have a sensation of contact with hard, sharp-cornered objects as my brain interprets the messages transmitted by my nerves. The mental image and the sensations are real; I infer that the external objects are also real. But this is inference and must always remain so. If I hasten toward the door as quickly as possible, any one would expect me to follow a path which would avoid the intervening obstacles even though that path is far longer than the straight line which is the shortest distance between two points. That is, I would be expected to act in a rational manner, on the assumption that my senses report accurately the nature of the external world. On the other hand, if there were a very small child in the room, able to move around but not yet old enough to draw inferences from experience, it would not be surprising if that infant, desiring to go to the door, should take

the most direct route regardless of the obstacles in its path. Each individual learns, by the well-known process of trial and error, that it is good judgment to trust the verdict of his senses. This we do, even though occasionally our senses or our minds mislead us by presenting pictures of our surroundings which we later discover to be erroneous.

The scientist, having made these fundamental assumptions, attempts to explain the phenomena which he has learned can safely be accepted as real. But he does not wait for explanation before he acts. He constructs hypotheses and proposes theories. Having found an explanatory hypothesis which may possibly be true, even though it be only a partial explanation and still unproved, he acts just as if he knew that the hypothesis were true. Only thus can he discover whether it be true or not. The method of science has been abundantly validated by the results; the faith of science is justified by its works.

Science deals with the measurable transforma-

tions of matter and of energy. All scientific observations and experiments are either directly or indirectly related to points on a scale or to ticks of a clock. Weights and balances, calipers and measuring rods, pendulums and chronometers, voltmeters and pressure gauges, are the familiar essentials of every scientific laboratory. Only the time-space relations of things and of forces are measurable. It is with these relations only that science can deal.

Nobody knows whether all the transformations of matter and of energy are measurable or not. Certainly many such transformations are not now measurable; scientific technique is still far short of scientific aspirations. At present, for example, the intensity of human love, or the beauty of a sunset cannot be measured. You say you love this person more than that one; yes, but how much more? You say that yester-evening's sunset was more beautiful than the sunset at which you are looking to-night; yes, but how much more? Love and beauty are not yet resolvable into units of a scale or

ticks of a clock; either they have no time-space relations or those relations are not yet susceptible to measurements. It is, however, conceivable that even so intangible realities as these may some day be related arithmetically to points on a scale of intervals on a clock. Already something is known concerning the biological effects of emotions, and the intensity of affection is in part indicated by increased or decreased heart beat or blood pressure and by other measurable phenomena. The technique of the psychologist in part depends upon devising machines or tests which permit the measuring of time-space relations such as these.

Whether or not all of the transformations of matter and of energy involved in affection for another, appreciation of beauty, the development of character, the building of ideals, the transmission of ideas, will ever be measurable, I do not know. Be that as it may, science is becoming increasingly aware of realities which have no relation to time and space, nor ever

can. There are immeasurable or non-metrical realities in the world.

For example, a red and a white billiard ball react in identical fashion to identical impulses. So far as their time-space relations are concerned there is no difference between them; energy is transmitted from the moving billiard cue to either ball with absolute disregard of its color. In computing the route traversed from cushion to cushion and the point finally attained as the ball stops moving, the physicist makes no use of the color of the ball. He considers its weight, its size, its elasticity, but not its color. The methods and the formulæ which he has developed, prove adequate; his computations enable him to predict exactly where the ball will come to rest. The expert billiard player uses the time-space relations of the ball and its surroundings in the same way, and he too gets the same result. For him as for the physicist, so far as determining the blow to be struck against the ball is concerned, its color is absolutely non-existent. The game could be played

with all white or all red balls. Nevertheless, to the players in the game the colors are of great value. When each ball may be recognized unhesitatingly by its color, the game is far more enjoyable and the chances of ending it in a spirit of good fellowship are much greater. Obviously, to the player the color is just as real as the other time and space relations of the ball.

This illustration opens the door into the world of values, a realm of which science is at last beginning to take cognizance. There are realities with which science does not ordinarily deal, and fortunately many of them have far greater value than has the color of balls to be used in a billiard game. The beauty of the sunset is just as real as the helium in the sun's atmosphere; a man's personality is just as real as his clothes; the moral quality of the universe is just as real as the stars.

This is the distinctive field of religion, the field of values. Such realities present a great opportunity to human beings. The accompany-

ing responsibility of discovering the values in the universe is increased rather than lessened by each advance of scientific knowledge. The more precise and efficient our implements for measuring space and time, the more extended and detailed our knowledge of time-space relations, the more values there are to be recognized and appraised by religion. There is therefore fundamentally no possibility of ever discovering that as science increases, religion must decrease. Quite the contrary, the more we know about the world of measurable realities, the more values are there to be used in religion.

It is in theology that science and religion join hands, for theology is, or should be, truly scientific. The word has a similar meaning to that of the analogous terms, geology or physiology. Each implies the discovery of realities in some particular field of investigation. Theology is the science of spiritual realities. It deals not so much with "natural law in the spiritual world" as with spiritual law in the natural

world. Spiritual realities cannot be defined or described in terms of time or space; they have no time-space relations. They are therefore non-metrical. They are not realities which with the advance of scientific technique will be transferred from a temporary position outside the pale of the measurable into the field of the measurable; they are inherently and eternally non-metrical.

In its etymology "spirit" means attenuated matter, breath, or vapor. The classical root recurs in many common terms, such as inspiration and respiration. Breath was the vaguest, most diffused and attenuated form of matter known to those who first coined the phrase. But when a man of science states that God is spirit, he does not mean a ghost or a wraith. He means that God is absolutely non-material, the very antithesis of matter. Therefore spiritual realities may be recognized only by their products.

Certain qualities of the spiritual are revealed by the measurable transformations of matter or

energy, which they produce in time and space. Consequently, among the "fruits of the spirit" are realities which are distinctly in the field of science. It is because of this, that science and religion cannot be wholly dissociated from each other. It is impossible to relegate science to one side of a tight barrier and religion to the other; there is a region in which the two overlap. Those qualities of the spiritual which are revealed by measurable transformations of matter and of energy in time and space should be studied scientifically, just as the strength of gravity is determined by noting its effect upon the pendulum or the moon. By such study men of science may be led, "through Nature to Nature's God." A consideration of the causes which have produced the effects which the scientist observes and measures, has frequently, but not necessarily, resulted in a recognition of the presence of spiritual realities which fill and thrill the universe. But other qualities of the spiritual are revealed only in the discovery of values. They have no time-space relations and

are not perceptible to the five senses. These are distinctly in the field of religion; it is religious insight rather than scientific observation which permits their recognition.

Inasmuch as science has by no means completed its survey of the measurable, we should not expect always and easily to find perfect harmony between science and religion. Much more must be learned about the world in which we live, before we may expect all discussions to be settled. It is now impossible to state whether certain realities or qualities are measurable and therefore in the field of science, or non-measurable and therefore in the field of values. In the meanwhile, it is well to recognize the overlapping or debatable territory in which coöperation on the part of all in the search for truth is apparently essential to success. It should not, however, be a source of great discouragement if conflicts arise between scientists and theologians. Even the most learned and open-minded scientist may find himself temporarily in opposition at some point to the most rational-minded and

intelligent man of religion. Both the theologian and the scientist have a long way to go before the problems of life are all solved and Truth is completely known.

The " man in the street " is firmly convinced that the scientist is able to discover the facts which pertain to the measurable transformations of matter and energy. He is not so sure that the qualities of the spiritual which have no relation to time and space can also be grasped with precision and certainty. He may take refuge by binding himself to the unreasonable idea that some particular official or document is magically authoritative and infallible. But sooner or later the active mind will inquire into the nature of such serfdom. Avenues of approach to knowledge concerning both tangible and intangible realities must surely be open to all; some individuals may advance farther along the avenue than others, but all may enter. There is no cornering of the market of wisdom; in a scientific age, no magic can pertain to authority in religion. It must be just as

reasonable to be aware of spiritual realities as of material realities. Such awareness is the essence of revelation; it is the crux of religious experience.

But revelation and experience are not identical. Revelation comes only through the interpretation of experience. An experience is neither true nor false; it may only be real or fancied. If it be real, then it is like a fact, neither right nor wrong, but simply an actuality. Just as statements concerning facts may be accurate or erroneous, so the interpretation of an experience may be true or false. It is the business of theology to sift the true interpretations from the false. Thus revelation rests upon human ability to understand the experiences of life.

Here the well known fallibility of human minds and senses throws an ominous shadow across the path. Can men be trusted to interpret religious experiences correctly? The world abounds with cranks, and more of them are of the religious variety than of any other; fanatics

concerning religion are to be found in every community. Of course, it is "human nature" to think that any person who does not interpret experiences just as we do, is either a crank or a fanatic; but that presents the problem. How may we escape agnosticism if we find so many people, apparently possessed of the same sort of intelligence or at least having somewhat similar bodies and brains, differing so widely in their interpretations of similar experiences that each declares all the rest to be fanatics? Can the seeker after truth concerning religion ever have any confidence in the theologian's ability to sift the true interpretations from the false?

The wise theologian is also a scientist. Applying the test of pragmatism, he asks the question, "How does it work, what are the results in human lives of each possible interpretation of the experience under consideration?" He answers the question by the appeal to facts of observation and experiment, not by any *a priori* reasoning nor by any consideration of what he thinks the results ought to be. That is the

method of science. It applies in the field of values just as truly as in the field of measurable realities. Obviously, on this basis no final verdict can be rendered in a theological dispute. What worked in the tenth century, fails utterly in the twentieth. It may have been "right" then; it is "wrong" now. This is the "yoke of the kingdom," not only "of heaven" but also of science. The 1927 model of the atom as depicted by the up-to-the-minute physicist is as unlike the 1917 model as the 1927 automobile is unlike the car of a decade before. Even so "styles in jehovahs" change from age to age. But just as the investigator in any field of scientific research discovers what others have already done in that field before he starts his own experiments, so the student of religion need not feel that he must himself test every possible experience and revelation. It is a wise generation which has learned to profit by the mistakes and the achievements of preceding generations.

The wise theologian is justly suspicious of the abnormal interpretation whether suggested

by himself or by others. That does not mean that he should necessarily discard a revelation as erroneous just because it appears to be unusual. Every great advance in human knowledge is first made by one or a few individuals who grasp the new idea far in advance of their fellows. For the time being the novel idea is abnormal; it has not yet been accepted as satisfactory by a large number of apparently intelligent human beings who are in a position to pass judgment upon the point at issue. Being suspicious, the theologian withholds his own unqualified approval until he and others have had time to test the proposition. If it passes the tests, he becomes its ardent champion, because he is justly confident of the ability of the composite mind of normal individuals. When any one interested in such matters as these finds many men thinking independently of each other, starting from widely separated points of approach, influenced by diverse heredities and environments, all reaching closely similar conclusions, he is justified in saying, "This is the

true interpretation: that of which these men are aware, is real."

To be aware of automobiles and stone walls is a prerequisite to existence; therefore we never doubt their reality. Individuals who do not become aware of such things do not live very long in the sort of world with which we are familiar. On the contrary it is perfectly possible, at least for a time, for human beings to exist without being aware of spiritual realities; therefore many persons doubt their actuality. But man does not live by bread alone; life for humankind is something more than mere existence. Certainly the higher life involves the type of awareness which religion strives to promote. This is the "eternal life" which unfortunately is often taken to mean quantity of existence instead of quality of life.

Awareness of the spiritual realities is something which comes to men who are philosophically minded. Apparently heredity and environment have their influence here as elsewhere. There are individuals whose heredity and en-

vironment cramp and confine their ability to become aware of God. There are other individuals whose potential resources in this field are of great extent; these may or may not convert their potential ability into actual attainments. Among those who do, may be found each generation's authorities in religion.

Theology makes two fundamental assumptions, analogous to those at the base of all natural science. Not only does it assume that men can interpret correctly the unseen reality of which they are aware; it also has faith in the uniformity of spiritual laws. The theologian bases his habits of mind and stakes his reputation on the assumption that there are laws in the spiritual realm of non-measurable realities of which he feels certain he is aware. Further, he makes another assumption which has no analogue in natural science because it is truly in the field of values. He assumes that the universe is essentially right: that the cosmic principle is beneficent, not malevolent; loving, not hateful. He proclaims that the heart of

the universe is love; that the world in which we live, superficial appearances to the contrary notwithstanding, is essentially kind; that "God is good." The theologian can no more prove that assertion than the physicist can prove the assertions which he makes concerning the nature of the external world of sense perception. Theology justifies that assumption and validates that conclusion only by experience. One person may "prove" it to his own satisfaction by his own individual experiences, but for the human race as a whole there can be no proof until the final outcome of the evolutionary process has been realized. Just as the physicist makes his assumptions and then acts as though they were true, so the theologian lives by faith.

Cause and effect are not so obviously related in the spiritual as in the physical realm. Not only are there many who are wholly unaware of spiritual realities, but those who are aware of them are not so firmly convinced of the uniformity of law in this particular realm. It has not yet been sufficiently demonstrated that spir-

itual cause is inevitably and uniformly followed by spiritual effect. Because the effects of the operation of spiritual laws are difficult to observe, they are frequently slow in assuming propositions large enough to be impressive. Consequently the cause is forgotten by the time the effect is noted. Even if a spiritual principle has been recognized through observation of the activities of other persons, an individual often refuses to believe that the law applies to him as well as to them. The fact that we are individuals is easily interpreted as meaning that we are sufficiently different from others to escape the inexorable working of the spiritual laws which we know apply to them. Others should "watch their steps," but I can safely "play with fire," is a subtle thought which insidiously enters the mind. Or if the individual has learned in the school of experience to subjugate his pride and distrust his own superiority to the laws of the spirit, he may take refuge in the expectation that a benign Providence will upon request and

in consideration of proper penitence set aside the regulations in his special case.

In other words, the actual presence and inexorable operation of law in the spiritual realm have not yet been adequately appreciated. Men have no such universal respect for the laws of the spirit as for the law of gravity. But give us time, and we shall either learn or die. Unless the individual develops respect for spiritual laws and orders his life in accordance with them, his ability to become aware of the moral qualities in the administration of the universe will decrease, atrophy and eventually disappear altogether. Although he may continue to exist, he does not live; he becomes that paradoxical reality, a dead soul. As for the individual, so for the human race collectively; it must learn to utilize the administrative regulations in the realm of the spirit or it, too, must die. The earth upon which our physical existence depends, is a temporal and local reality. Its time-space relations place it in the midst of a continuous cycle of changing events. Just as

the solar system came into existence at a definite time and place as a result of measurable transformations of matter and energy, so at a future time and distant place it will pass through another episode of cataclysmal alteration. Doubtless the earth will remain pleasantly habitable for mankind for many million years to come, but eventually it must cease to be a fit abode for creatures organized in response to the environment that has so long characterized it. In spite of the superior adaptability of man, it is nevertheless certain that there are definite physical limits beyond which he cannot go. He is committed by the choices which his ancestors made, or which were made by environment for his ancestors. These limits of surface temperature, air content, electromagnetic fields, etc., will sooner or later be transcended by the earth. As a physical reality in the world of sense perceptions man's days are numbered. Postponing the event for scores of millions of years as we are probably justified in doing, has

no bearing whatsoever upon its philosophical implications.

Certain of those implications are readily apparent. If there are eternal values in the universe, they must be such as to be independent of the earth with its limitations of time and space. Man recognizes values in that which he perceives; he cannot describe those values in terms of time and space. He is therefore justified in assuming that they transcend time and are truly eternal. It is a reasonable assumption that the values of which we are aware, or may become aware, have quantity as well as quality of reality. If so, they are not dependent upon the physical environment of the earth. Insofar as they are appropriated by mankind and become a part of human life, life is indestructible.

If man achieves immortality, it will be because he, although a creature of the earth, who so far as his physical being is concerned is limited to the mundane environment, has nevertheless become sufficiently aware of the spiritual

values in existence to incorporate them in his very being. Eternal life, therefore, from the quantitative as well as the qualitative point of view must be sought in the field of values rather than of materials, of the non-measurable rather than of the measurable, of religion rather than of science.

To discover the moral quality of the universe, man must be vividly aware not only of those things which have time-space relations, but also of those values which transcend such relations. That discovery is possible only through the coöperative endeavor of those who strive to utilize all potential capabilities of mankind. Toward this goal, science and religion are advancing hand in hand.

INDEX

Animism, 56ff
Anthropomorphism, 70f, 73f
Astronomy, 6f, 11ff, 21
Atheism, 60
Authority in religion, 37ff, 132, 144

Beliefs, 44, 49, 132
Bible, 37ff, 112ff
Biology, 14ff
Body and mind (*see* Dualisms)
Botany, 18

Cause and effect (*see* Natural law)
Chemistry, 18, 62, 64
Creative energy, 12, 19, 22, 71f, 75ff, 99, 130

Deism, 58ff, 115
Determinism, 79ff, 94f
Dualisms, 19, 47, 54, 65, 72ff, 104f

Einstein Theory, 47
Energy, 65, 123, 136
Environment, influence of, 67, 81, 90ff, 95ff, 100ff, 149f
Environment, man's control of, 101ff, 116f
Evil, problem of, 24, 60, 107ff
Evolution, 32ff, 67f, 76, 86, 89ff, 97ff
Experimental method in religion, 49ff, 140, 146ff

Faith, 131f
Fatalism, 83
Freedom, 26, 95ff, 102, 104, 125ff

Galileo, 33
Geology, 21, 43, 62, 83ff, 96ff
God (*see also* Deism; Immanence; Jehovah; Omnipotence; Personality; Theism; Transcendence); as law-abiding, 74f, 106ff, 120, 129; as spirit, 72ff, 141ff; omnipotent or limited, 119ff, 128

Heredity, 81, 93ff, 97ff, 149f
Huxley, 30, 79

Ideas, power of, 79, 103ff, 127
Immanence of God, 59, 69ff
Immortality, 155f
Inspiration, 44f, 72
Instinct, 80f

Jehovah, 23, 40, 70, 107
Jesus, 31, 41, 45, 118
Judaism and Christianity, 40ff, 58

Law, (*see* Natural law, Spiritual law)
Linnaeus, 20

Magic, 23, 56, 59, 76, 106, 144
Man differentiated from other animals, 68f, 100
Matter and energy, 65
Matter and spirit, (*see also* Dualisms); defined, 73
Mechanism, 25ff, 51, 79ff, 84, 98, 105
Miracles, 108ff
Monism, 18
Monotheism, 40ff
Mysticism, 76f, 105

Natural law, 8, 23ff, 28f, 60, 79ff, 84, 90, 103f, 106ff, 121ff, 140f

Omnipotence of God, 119f, 125
Organisms, 26, 75, 31ff, 98, 100

Paul, 31
Personality in the universe, 71, 108, 118, 129; in man, 75
Philosophy of religion distinguished from theology, 44
Physics, 18, 63, 151
Prayer, 25, 108, 120ff, 128ff
Pre-scientific age, 5f, 13f, 20ff, 38, 58, 110ff
Priests and prophets, functions of, 50ff
Primitive religion, 23, 56f
Protestantism, 36ff
Psychology, 18, 76, 94, 103, 137
Psychotherapy, 114

Quantum theory, 47f, 122f

Religion and science (*see* Science and religion)
Religion and theology distinguished, 43f
Religion as a way of life, 44, 47, 54
Religious concepts, development of, 34f, 40ff, 52, 55ff
Religious experience, 76ff, 145
Revelation, 42, 132, 148
Roman Catholicism, 34ff

Science and religion, 28, 34, 38, 43, 45ff, 50ff, 61ff, 74ff, 117f, 131ff, 143ff, 156
Science, assumptions of, 7, 67, 133ff, 151
Scientific method, 7ff, 28ff, 43, 61ff, 66, 104, 136ff
Sense perception, 7, 43, 53, 65, 133ff, 145
Sociology, 94
Solar system, 6, 8ff, 21, 154
Soul, emergence of, 68
Species, plant and animal, 15ff
Spirit, 73, 141
Spiritual law, 150ff
Spiritual realities (*see also* Values), 54, 68, 73ff, 77, 137, 140f, 149
Supernatural, 18, 23, 56, 119

Theism, 69ff
Theology, 28, 34, 42ff, 48, 52f, 140ff, 146ff; assumptions of, 150f
Time-space relations, 136ff, 142, 153
Transcendence of God, 58ff, 72, 130

Universe, 8ff, 13, 51, 65
Universe, administration of, 22, 48, 55ff, 106ff, 118ff, 129

Values, 27, 45ff, 54, 63, 68, 118f, 137ff, 147, 150, 155
Vital energy, (*see* Creative energy)

Zoology, 18, 67

859
71

6EN
.75

LOGICAL SEMINARY

United Theological Seminary Library
MAIN BL240.M36 1928
Mather, Kirtl Science in search of God /
3 0645 0002 8183 8